STAR

Scientific and Technical Aerospace Reports

A SEMIMONTHLY ABSTRACT JOURNAL

AUGUST 23, 1969

VOLUME 7 • NUMBER 16

N69-29001—N69-30400

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
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Scientific and Technical Aerospace Reports, Volume 7, is prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by the Technical Information Services Company.

Use of funds for printing this publication approved by the Director of the Bureau of the Budget June 7, 1966.

Introduction

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Scientific and Technical Aerospace Reports (STAR) is a comprehensive abstracting and indexing journal covering worldwide report literature on the science and technology of space and aeronautics. It is published on the 8th and 23rd of each month.

The following publications are abstracted in *STAR*:

Scientific and technical reports of the National Aeronautics and Space Administration and its contractors; scientific and technical reports of government agencies, universities, and research organizations throughout the world.

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Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics. **2874**

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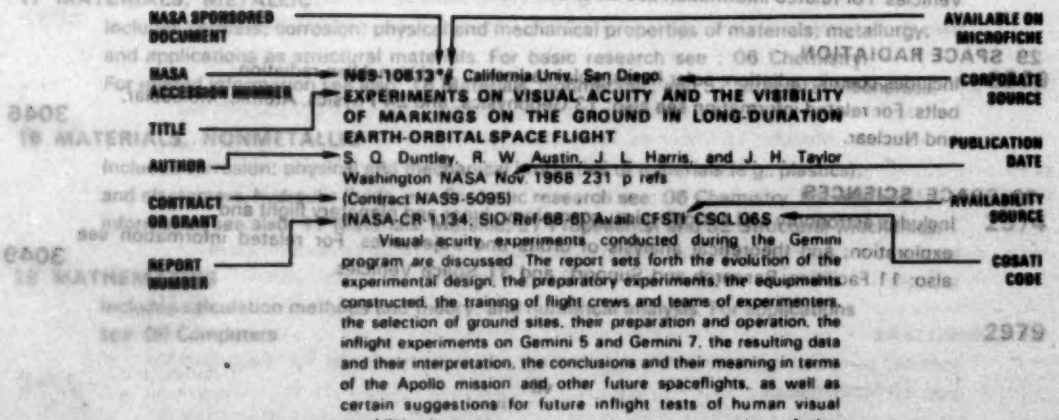
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N69-10813*# California Univ., San Diego.
EXPERIMENTS ON VISUAL ACUITY AND THE VISIBILITY OF MARKINGS ON THE GROUND IN LONG-DURATION EARTH-ORBITAL SPACE FLIGHT
S. Q. Duntley, R. W. Austin, J. L. Harris, and J. H. Taylor
Washington NASA Nov. 1968 231 p refs
(Contract NAS9-5095)
(NASA-CR-1134; SIO-Ref-68-6) Avail: CFSTI CSCL 06S
Visual acuity experiments conducted during the Gemini program are discussed. The report sets forth the evolution of the experimental design, the preparatory experiments, the equipments constructed, the training of flight crews and teams of experimenters, the selection of ground sites, their preparation and operation, the inflight experiments on Gemini 5 and Gemini 7, the resulting data and their interpretation, the conclusions and their meaning in terms of the Apollo mission and other future spaceflights, as well as certain suggestions for future inflight tests of human visual capabilities in space.
Author

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Scientific and Technical Aerospace Reports

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01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N69-29027*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

AERODYNAMIC CHARACTERISTICS DETERMINED DURING DEVELOPMENT OF THE APOLLO LAUNCH ESCAPE VEHICLE CONFIGURATION

William C. Moseley, Jr. and Francis Evans Bowen. Washington Jun. 1969 89 p refs

(NASA-TN-D-5208) Avail: CFSTI CSCL 01A

Wind tunnel studies were conducted in the development of the Apollo launch escape vehicle to determine the effect of configuration changes on the aerodynamic characteristics of the vehicle. Results indicate that changes in escape tower and rocket-body length had only slight effects on the static stability. Author

N69-29149# Indian Inst. of Science, Bangalore. Dept. of Aeronautical Engineering.

CONICALLY CAMBERED TRIANGULAR WINGS WITH REFLEX SPANWISE CURVATURE

V. S. Holla and T. N. Krishnaswamy Dec. 1968 61 p refs

(AE-227A) Avail: CFSTI

The wings considered are those having subsonic leading edges and supersonic trailing edge with zero load along the leading edge at the design condition. The wings are designed by imposing four geometric conditions on the wing shape, and effect of changing each of the parameter z_1/z_2, $\tan\theta$ and η_1 are studied. It is shown through numerical examples that these wings have good aerodynamic characteristics comparable to those of plane triangular wings with leading edge suction. Author

N69-29154*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

AERODYNAMIC INVESTIGATION OF SHARP CONE-CYLINDER SPIKES ON 120 DEGREE BLUNTED CONES AT MACH NUMBERS OF 3.00, 4.50, AND 6.00

Robert J. McGhee and W. Frank Steyler. Washington Jun. 1969 42 p refs

(NASA-TN-D-5201) Avail: CFSTI CSCL 01A

Some effects of sharp cone-cylinder spikes located at the apex of two 120° spherically blunted cones were investigated at free stream Mach numbers of 3.00, 4.50, and 6.00 at angles of attack of 0°, 2°, and 5°. Spikes of various lengths, diameters, and tip angles were tested, and surface-pressure distributions and schlieren photographs were obtained for the models. The free-stream Reynolds numbers were 6.89, 2.95 and 3.64 x 10^6 per meter at free-stream Mach numbers of 3.00, 4.50, and 6.00, respectively. Several distinct types of flow which occurred on the spikes were found to be a function of the parameter l/δ, the ratio of the spike-cylinder length to the bow-shock stand-off distance at the stagnation point. For spike lengths of $l/\delta < 0.8$, subsonic steady flow existed over the entire model with a small region of separated flow near the spike. The bow shock was detached and unsteady in the vicinity of the spike for $0.8 < l/\delta < 1.0$. The bow shock attached to the spike tip at about $l/\delta = 1.1$ and remained steady until flow oscillation again occurred at $l/\delta > 2.2$. A region of relatively low pressure separated flow occurred behind the attached bow shock and was followed by a high reattachment pressure near the intersection of the attached spike shock and detached body shock. Author

N69-29190# Boeing Co., Seattle, Wash. Office of International Operations.

CALCULATION OF INVISCID HYPERSONIC FLOW AROUND ELONGATED BLUNT SOLID BODIES, TAKING INTO ACCOUNT EFFECTS OF REAL GAS

Peter Mittelbach Jan. 1969 20 p refs Transl. into ENGLISH from German Presented at WGLR Meeting on Aerodynamics, 1-4 Oct. 1968

(B-836) Avail: CFSTI

A report is made on the results of equilibrium and frozen flow around elongated blunt bodies of revolution obtained by means of the integral method in single-strip approximation and the characteristics method. The integral method is described in more detail for the case of a real gas with a general equation of state. Author

N69-29196# National Aeronautical Establishment, Ottawa (Ontario).

MEASUREMENTS OF FLOW BREAKDOWN IN RECTANGULAR WIND TUNNEL WORKING SECTIONS

P. South Nov. 1968 16 p refs

(AD-684711; NAE-LR-513; NRC-10615) Avail: CFSTI CSCL 20/4

The report describes an experimental investigation of the model lift coefficients required to cause flow breakdown in low speed wind tunnels having test section breadth-to-height ratios of 0.5, 1.0, and 2.0. A family of jet flap wing models was used in the investigation. The model height-to-span, the momentum-area-to-tunnel area, and the model drag-to-lift ratios were varied. Flow breakdown is shown to be primarily a function of the drag-to-lift ratio and a lift coefficient based upon the measured dynamic pressure, measured lift, and the tunnel cross-sectional area beneath the model span. Author (TAB)

N69-29199 Boeing Co., Seattle, Wash. Office of International Operations.

SOME TRANSONIC FLOW PROBLEMS FOR ENGINE NACELLES OF AN "AIRBUS" TYPE AIRCRAFT

Jacky Leynaert et al Jan. 1969 19 p refs Transl into ENGLISH from French Presented at Fluid Mech. Group of AGARD on Transonic Aerodynamics, Paris, 18-20 Sep. 1968

(E-266) Avail: CFSTI

The transonic aspects of air intake at takeoff and in cruising flight, the air intake at a fixed point and at very low speeds, and the problem of the boattail and the center body in cruising flight are considered. A cowling is defined whose external profile is free of the transonic supervelocity and the resulting drag due to the shock waves and increased friction during cruising flight. An optimized nacelle is derived and used as a point of departure for the optimization of the nacelle-fuselage configuration. The pressure distributions on the cowling, the rear profiles, and the external and internal profiles of the air intake are determined. It is shown that a reduction in the thickness of the leading edge attenuates the supervelocities but impairs the takeoff performance. A regular flow coopression is observed on the boattail of the fuselage. K.W.

N69-29207# Canadian Armement Research and Development Establishment, Valcartier (Quebec).

SOME OBSERVATIONS ON THE APPLICATION OF COOLED-FILM ANEMOMETRY TO THE STUDY OF THE TURBULENT CHARACTERISTICS OF HYPERSONIC WAKES

E. Ellington and G. Trottier *In* Md. Univ. Advan. in Hot-Wire Anemometry Jul. 1968 p 52-64 refs (See N69-29201 16-14)

(ARPA Order 133)

Avail: CSFTI

The techniques of cooled-film anemometry were used in studying the turbulence characteristics of hypersonic projectile wakes in free-flight ranges. A two-temperature method was used to determine the mean and fluctuating components of temperature and velocity. In its application, the method was subject to errors in the calibration, measurement, recording, reading, and analysis phases of the work. These errors are discussed, and suggestions are made for the improvement of the technique in order to obtain meaningful results. Author

N69-29210# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.

NEW TURBULENCE MEASUREMENTS IN TUBES

R. E. Kronauer *In* Md. Univ. Advan. in Hot-Wire Anemometry Jul. 1968 p 86-101 refs (See N69-29201 16-14)

Avail: CFSTI

The phenomenon of turbulent flow adjacent to a solid boundary is analyzed using a smooth, constant diameter, circular tube. The analysis was intended to indicate possible new applications of hot-wire anemometry by emphasizing the general correspondence between tube flow and equilibrium boundary layer flow. Reynold's number was used as the single parameter, since a sufficiently low Mach number was assumed so that the density could be taken as constant. It was concluded that there are a number of useful three-point correlation studies which involve no more than two independent variables at any given stage. In addition, although the arrangement for a single data point is more complicated than for two-point correlations, data accumulation can proceed at the same speed as the latter. A.C.R.

N69-29226*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

CALCULATION OF THE FLOW AROUND WINGS OF ARBITRARY PLANFORM IN A WIDE RANGE OF ANGLES OF ATTACK [RASCHET OBTEKANIYA KRYLYEV PROIZVOLNOY FORMY V PLANE V SHIROKOM DIAPAZONE UGLOV ATAKI]

S. M. Belotserkovskiy Washington NASA May 1969 20 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk: Mekhan. Zhidkosti i Gaza (Moscow), no. 4, Jul.-Aug. 1968 p 32-44

(Contract NASw-1692)

(NASA-TT-F-12291) Avail: CFSTI CSCL 01A

A description is given of a numerical method for calculating the distributed and combined aerodynamic characteristics of a thin wing of arbitrary planform. The vortex layer simulating the wing surface is replaced by a system of discrete vortices. The free vortices beyond the wing represent discrete curvilinear vortical filaments. Each of these filaments is replaced by a number of rectilinear vortical segments. The number of attached and free discrete vortices may increase infinitely. The position of the free vortical segments is determined during the process of computation, which is carried out successively for a number of angles of attack. Author

N69-29227# Boeing Co., Seattle, Wash. Office of International Operations.

CALCULATION OF THE PRESSURE DISTRIBUTION ON SLENDER BODIES WITH ARBITRARY PLANFORM AND CROSS-SECTION IN SUBSONIC AND SUPERSONIC FLOW

D. Hummel Mar. 1969 28 p refs Transl. into ENGLISH from German Presented at ICAS Meeting, Munich, Sep. 1968

(B-808) Avail: CFSTI

A method is presented to calculate the pressure distribution and the overall forces and moments of low aspect ratio bodies of finite thickness according to slender body theory. The corresponding two-dimensional problem in the plane of the cross-section is solved using the method of continuous distributions of vortices and sources which are located on the contour. Arbitrarily shaped cross-sections with rounded edges as well as with sharp edges can be treated. The influence of Mach number is determined by solving the complete linearized potential equation for the equivalent body of revolution for subsonic and supersonic speeds. The method is applied to the supersonic flow around conical bodies with arbitrary cross-sections and to the subsonic and supersonic flow around a non-conical body. the results are compared with thin wing theory, slender thin wing theory, and experimental data. Author

N69-29231*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

TRANSONIC AERODYNAMIC CHARACTERISTICS OF TWO HYPERSONIC CRUISE CONFIGURATIONS

Richard A. Langhans Washington Jun. 1969 98 p refs

(NASA-TM-X-1818) Avail: CFSTI CSCL 01A

An investigation was conducted in the 8-foot transonic pressure tunnel to determine the aerodynamic characteristics of two hypersonic cruise airplane configurations. The investigation was conducted at Mach numbers ranging from 0.80 to 1.20, angles of attack from approximately $-5°$ to $15°$, and constant Reynolds number per meter of 13.12×10^6. The results of the investigation show the distinct wing-body configuration is longitudinally unstable for the chosen center-of-gravity location and has a pitch-up tendency. This configuration is directionally stable and has positive effective dihedral. The blended wing-body configuration is longitudinally stable at Mach numbers greater than 0.90 and unstable at Mach numbers from 0.80 to 0.90. This configuration is directionally stable and has positive effective dihedral. Author

N69-29237*# Techtran Corp., Glen Burnie, Md.

EXPERIMENTAL STUDY OF LOW DENSITY HYPERSONIC FLOW USING ELECTRON BEAM DENSITOMETRY

Isamu Wada and Kunio Soga. Washington NASA Jun. 1968 29 p refs Transl. into ENGLISH from Natl. Aerospace Lab. of Japan Rept. TR-157
(Contract NASw-1695)
(NASA-TT-F-12177; TR-157) Avail: CFSTI CSCL 01C

The absorption and fluorescence methods of electron-beam densitometry were developed for flow measurement in the test section of a shock tunnel. A flat plate with a sharp leading edge is investigated in a hypersonic flow having a Mach number of 6.5 and Reynolds numbers of 16,000, 2,000, and 1,000 per centimeter. The induced surface pressures near the leading edge at small Reynolds numbers are significantly smaller than those predicted by the strong and the weak interaction theory. The hypersonic low-density wakes behind spheres 0.2 cm and 0.395 cm in radii and a cylinder 0.195 cm in diameter are investigated in detail. The radial density distributions across the shock layer and the wake at various distances downstream from the spheres are measured at free-stream Mach numbers of 7.35, 6.9 and Knudsen numbers (based on the radius of the sphere and the diameter of the cylinder) from 0.056 to 0.25. Author

N69-29238*# Boeing Co., Seattle, Wash. Office of International Operations.
ON THE INFLUENCE OF VORTEX BREAKDOWN ON THE AERODYNAMIC COEFFICIENTS OF LOW-ASPECT RATIO DELTA WINGS IN YAW
D. Hummel et al Mar. 1969 23 p refs Transl. into ENGLISH from German Presented at Ann. WGLR Meeting, Karlsruhe, West Ger., Oct. 1967
(B-659) Avail: CFSTI

The influence of vortex breakdown on the aerodynamic coefficients of delta wings in asymmetrical incompressible flow is discussed. Six-component measurements were made on two sharp-edged delta wings with aspect ratios $\lambda = 1.6$ and 2.3. In addition, vortex breakdown was illustrated by means of the smoke visualization technique. If the vortices breakdown above the wing, a very adverse drop of force and moment coefficients results which decreases in inverse proportion to the aspect ratio. The area of using low aspect ratio wings is therefore limited by breakdown of the vortices. It is shown that this area of application is strongly limited in asymmetrical flow. Author

N69-29260 Illinois Univ., Urbana.
OPTIMIZATION OF AIRFOILS FOR MAXIMUM LIFT
Robert Hauschild Liebeck (Ph.D. Thesis) 1968 100 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 69-1383

The pressure distribution which provides the maximum lift for a mono-element airfoil in an incompressible flow is determined using boundary layer theory and the calculus of variations. The airfoil profiles corresponding to these pressure distributions are determined approximately using second order airfoil theory. The results indicate maximum lift coefficients as high as 2.9 for Reynolds numbers between five and ten million, and the critical Mach numbers at these conditions are above 0.3. Dissert. Abstr.

N69-29265*# Boeing Co., Seattle, Wash. Office of International Operations.
AERODYNAMICS OF A MACH 7 AIRPLANE
R. Ceresuela Feb. 1969 26 p refs Transl. into ENGLISH from French Presented at AFITAE 5th Colloq. of Appl. Aerodynamics, Nov. 1968
(B-652) Avail: CFSTI

The study of long range hypersonic transports or high Mach interceptors creates numerous aerodynamic problems which are related in particular to the size of the engines. Inlet and outlet sections, which at hypersonic speed are considerable in size, must be subjected to forces that are compatible with controlled flight at all regimes. In order to identify these problems and to emphasize the special features of such high sweep airplanes, an experimental wind tunnel program was carried out on a Mach 7 airplane model. The first results of force measurements, obtained in the whole range from subsonic to supersonic, are presented with particular emphasis upon the contribution of nacelles and fins on the aerodynamic characteristics. Author

N69-29299*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
AN EXPERIMENTAL AND THEORETICAL INVESTIGATION OF A SYMMETRICAL AND A CAMBERED DELTA WING CONFIGURATION AT MACH NUMBERS FROM 2.0 TO 10.7
Walter P. Nelms, Jr., Ralph L. Carmichael, and Charles R. Castellano Washington Jun. 1969 34 p refs
(NASA-TN-D-5272) Avail: CFSTI CSCL 01A

The effect of wing camber on the longitudinal aerodynamic characteristics was studied for a configuration representative of an airplane designed to cruise at hypersonic speeds. A 70° sweep delta wing with a symmetrical section and 4-percent thickness ratio was compared to one of identical planform and thickness which was cambered so as to have a flat lower surface. Experiment data were obtained at eight Mach numbers from 1.99 to 10.70 and compared with estimates from three different theoretical procedures. It was found that a configuration with a flat-bottomed wing was in no way superior to a similar configuration with a symmetrical wing section. In fact, at the lowest Mach numbers of this study the flat-bottomed wing had a large negative pitching moment at zero lift, which would indicate fairly substantial values of trim drag. The characteristics could be predicted with fair accuracy by the tangent-wedge/tangent-cone procedure. Author

N69-29270*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
USE OF TETRAFLUOROMETHANE TO SIMULATE REAL-GAS EFFECTS ON THE HYPERSONIC AERODYNAMICS OF BLUNT VEHICLES
Robert A. Jones and James L. Hunt Washington Jun. 1969 134 p refs
(NASA-TR-R-312) Avail: CFSTI CSCL 01A

An experimental and theoretical study was made of the use of CF_4 in low hypersonic flows as a means of simulating the flow field over the forebody of blunt configurations in hypersonic flight where dissociation of the gas in the shock layer gives large density ratios across the shock wave. A pilot model hypersonic CF_4 blowdown tunnel was built and studied. With this facility a normal-shock density ratio of 12.1 was obtained at a Mach number of 6 with stagnation conditions of 1650 N/cm^2 and 736°K. The results indicate that flow fields over the forebody of blunt configurations for real-gas conditions resulting in normal-shock density ratios up to 17 can be simulated by this method. A computer program for isentropic flow of CF_4 as well as flow across normal and oblique shocks was set up. Plots of various flow parameters are presented as a function of free-stream Mach number for various stagnation temperatures. A method for computing axisymmetric nozzle contours which includes a correction for boundary-layer displacement thickness is described. Author

N69-29318*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
MEASUREMENTS OF MUTUAL INTERFERENCE HEATING FOR A PROBE ANTENNA MOUNTED ON AN APOLLO REENTRY CONFIGURATION

Robert A. Jones and James L. Hunt Washington Jun. 1969 38 p refs
(NASA-TM-X-1787) Avail: CFSTI CSCL 01A

A study was made at a Mach number of 8 to determine the interference heating effects of a probe antenna located on the windward afterbody of an Apollo model at a 25° angle of attack and protruding ahead of the undisturbed main bow shock. The interference heating effects were observed to occur only on the windward part of the afterbody. The presence of the probe antenna resulted in peak heating rated as large as 23 times the local value for a model without a probe or 2.3 times the reference heat transfer coefficient, which was the calculated heat transfer at the stagnation point of the Apollo model at an angle of attack of 0°. This interference heating to the afterbody was very sensitive to Reynolds number with the highest heating rates occurring at the highest Reynolds numbers. The maximum interference heating rates to the probe occurred at the point where the slip-flow line emanating from the intersection of the body bow shock and the probe shock impinged on the lower edge of the probe. The value of this maximum heat transfer rate to the probe was 15.5 times the reference value or 1.3 times the estimated value for the probe leading edge subjected to the undistrubed local flow conditions immediately behind the body bow shock. Author

N69-29479*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF TWO DIMENSIONAL INVISCID MODEL OF JET IMPINGEMENT UNDER VERTICAL-TAKEOFF AIRPLANE
Robert Siegel and Marvin E. Goldstein Washington Jul. 1969 36 p refs
(NASA-TN-D-5288) Avail: CFSTI CSCL 01A

Conformal mapping was used to obtain the free streamline pattern and surface pressure distribution for downward jet flow issuing from two parallel slot nozzles. After striking the ground, a portion of the flow from each jet moves along the ground toward the centerline between the jets. When these two portions collide, an upflow results which strikes a plate above the ground simulating the undersurface of an airplane fuselage. Typical flow patterns are shown to illustrate the effect on the free streamlines of nozzle height, nozzle spacing, plate height, plate width, and plate angle. Author

N69-29590# Boeing Co., Philadelphia, Pa. Vertol Div.
WIND TUNNEL TESTS OF THIN AIRFOILS OSCILLATING NEAR STALL. VOLUME 1: SUMMARY AND EVALUATION OF RESULTS Final Report, 27 Jun. 1967–15 Aug. 1968
Lewis Gray, Jaan Liiva, and Franklyn J. Davenport Jan. 1969 89 p refs
(Contract DAAJ02-67-C-0095)
(AD-684323; D8-0925-1-Vol-1; USAAVLABS-TR-68-89A) Avail: CFSTI CSCL 1/3

The report presents the results of an experimental investigation of rotor blade dynamic stall. Forces and moments in two-dimensional flow were determined for two thin airfoil sections (NACA 0006 and Vertol 13006-.7) usually considered in advanced helicopter rotor concepts by measuring differential pressure during oscillatory pitch motions. The Mach number, Reynolds number, and angle of attack prevailing in the retreating-blade stall region were investigated up to typical first-torsion mode natural frequencies. Pitch oscillation was shown to increase the angle of attack at which stall occurred, with a corresponding increase in maximum normal force. Hysteresis effects on the pitching moment response produced regions of negative aerodynamic damping in oscillations at mean angles of attack near the steady-flow stall values for all Mach numbers from 0.2 to 0.6. It is shown that dynamic stall effects are strongly related to the reduced frequency parameter. Significant evidence of compressibility effects appears only at Mach numbers higher than 0.4. At lower Mach numbers, the data indicate that the two effects of decreased Mach number and airfoil camber are fully comparable in terms of dynamic stall patterns and increase both the usable angle of attack and the maximum normal force. Author (TAB)

N69-29591# Boeing Co., Philadelphia, Pa. Vertol Div.
WIND TUNNEL TESTS OF THIN AIRFOILS OSCILLATING NEAR STALL. VOLUME 2: DATA REPORT Final Report, 27 Jun. 1967–15 Aug. 1968
Lewis Gray and Jaan Liiva Jan. 1969 283 p refs
(Contract DAAJ02-67-C-0095)
(AD-684324; D8-0925-2-Vol-2; USAAVLABS-TR-68-89B) Avail: CFSTI CSCL 1/3

The report presents the actual computer data that resulted from the two-dimensional tests of thin airfoils oscillating near stall. An introduction provides a general background, and a set of tables forms an index to specific data. More than 200 pages of computer data are included. Author (TAB)

N69-29623# Boeing Co., Seattle, Wash. Office of International Operations.
COMPUTATION OF SEPARATED INCOMPRESSIBLE FLOW AROUND AIRFOIL AND DETERMINATION OF MAXIMUM LIFT
K. Jacob Apr. 1969 38 p refs Transl. into ENGLISH from German Presented at WGLR Comm. Meeting for Aerodynamics, Berlin, 1-4 Oct. 1968 Submitted for publication
(B-819-36) Avail: CFSTI

For theoretical determination of pressure distribution and force coefficients for separated, plane, incompressible flows around profiles of any given form, a calculation method was presented based on the combination of a suitable ideal singularity method with a boundary layer calculation. By this method, the lift coefficient, in particular, can be calculated as a function of angles of attack and Reynolds number even for large angles of attack with separated flow. Pressure distributions and lift coefficients were calculated for some profiles and compared with measurements, showing good agreement. Author

N69-29673*# Techtran Corp., Glen Burnie, Md.
DISTRIBUTION OF PRESSURE ON JET-FLAPPED WINGS IN VIEW OF MIXING OF BLOWN OUT AIR CURRENT WITH AMBIENT AIR [ROZLOZENI TLAKU NA PROFILU KRIDLA S TRYSKOVOU KLAPKOU S UVAZENIM MISENI VYFUKOVANEHO PAPRSKU S OKOLNIM VZDUCHEM]
Milos Klusak Washington NASA Jun. 1969 18 p refs Transl. into ENGLISH from Zpravod. Vyzkumny a Zkusebni Letecky Ustav (Letnany), no. 5, 1967 p 19–25
(Contract NASw-1695)
(NASA-TT-F-12243) Avail: CFSTI CSCL 01A

The mixing of blown-out air current with ambient air is approximated due to the drops distributed along the air current. The absorption rate of drops, that is the amount of air sucked into the mixing field of the air current, is derived from the laws governing the air current blown-out of the slot into the flowing ambient air. These derived relationships register the effect of the velocity of flowing ambient air, the width of the slot, and blow coefficient. For computing the pressure distribution along a jet-flapped wing resulting from mixing a calculation method was developed which does not linearize this instance. The results of calculations in three instances have been compared with the experiment. Author

N69-29848# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF DISTRIBUTION OF PRESSURE ON SOME STAR SHAPED BODIES AT MACH APPROXIMATELY EQUALS 4
A. L. Gonor et al 26 Jul 1968 12 p refs Transl. into ENGLISH from Zh. Prik. Mekhan. i Techn. Fiz. (Moscow), no. 6, 1965 p 122–125
(AD-685517; FTD-HT-23-357-68) Avail: CFSTI CSCL 20/4

The results of an experimental investigation of pressure distribution on star-like bodies in supersonic flows in an aerodynamic wind tunnel at M = 3.85 plus or minus 0.1 and Re = 6,000,000 are presented. The models, experimental setup, and measuring techniques are described in detail. Pressure measurements were obtained by manometers with tetrabromoethane liquid (gravity = 2.96 g/cm cc). The boundary layer effect upon the flow structure for various angles between wings is investigated and shock wave structures for various angles of attack (from 5 to 15 deg) are analyzed. A comparison of the experimental results with the exact theoretical data obtained previously by the author shows good agreement for all models. The ratios between the wave drags of equivalent circular cones and wave drags of models calculated from experimental data indicate that in certain cases predicted by theory the wave drag is reduced several times. Author (TAB)

N69-29911# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMAL CONDUCTIVITY DURING THE EXTERNAL COOLING OF GAS TURBINE ROTOR BLADES
Ye. A. Levin Dec. 1968 13 p refs Transl. into ENGLISH from Inzh. Fiz. Zh. (Moscow), v. 13, no. 2, 1967 p 236–242
(AD-685016; FTD-HT-23-1051-68) Avail: CFSTI CSCL 21/5

An analysis of problems encountered in the development of internal cooling of rotor blades suggests that it may be possible to cool them by an external cooling method without changing the rotor design. To investigate the problem of external cooling, a study was made of the mean integral temperature of a plate in a quasi-steady-state to determine how much the temperature of a hot-plate will drop in a medium with periodic variations in the temperature and the heat transfer coefficient. It is concluded that due to the small fluctuation of the plate temperature, external cooling of turbine blades is practical. Author (TAB)

N69-29990# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AEROGASDYNAMICS A Concise Textbook
I. P. Ginzburg Nov. 1968 376 p refs Transl. into ENGLISH of the book "Aerogazodinamika (Kratkii Kurs)" Moscow, Izd. Vysshaya Shkola, 1966 p 1–404
(AD-685537; FTD-HT-23-490-68) Avail: CFSTI CSCL 20/4

The book contains theoretical fundamentals of modern aero-and gas dynamics with applications to problems of rocket and aeronautical engineering. Equations of gas motion, motion of an ideal fluid, theory of shock waves, rarefied gas flows over wings and bodies of revolution, the fundamentals of hypersonic aerodynamics, and problems of friction drag and heat transfer at subsonic and supersonic speeds are considered. The problems of reaction nozzle jets, the aerodynamics of rarefied gases and magnetogasdynamics are treated briefly. Author (TAB)

N69-30007# Weapons Research Establishment, Salisbury (Australia).
WIND TUNNEL TESTS ON AN AXISYMMETRIC, LIFTING BOMBLET WITH BODY MOUNTED, RECTANGULAR FINS
C. A. J. Fletcher Dec. 1968 40 p refs
(WRE-TN-HSA-141) Avail: CFSTI

Comprehensive wind tunnel tests have been conducted to ascertain the static and dynamic characteristics of an axisymmetric, lifting bomblet. The bomblet was designed to have a highly nonlinear pitching moment variation with incidence, causing it to trim in the 10° to 15° incidence range depending on the center of gravity position. The bomblet characteristics are nearly insensitive to Mach number in the range 0.35 to 0.80, and to Reynolds number in the range 2.1×10^5 to 4.4×10^5. Above M = 0.80 and below $Re \sim 2 \times 10^5$ the static characteristics, particularly the pitching moment variation with incidence, show a definite change. Changing the nose shape produced a significant change in the Magnus characteristics and a small change in the roll damping characteristics, but a negligible effect, discounting the use of nose strakes, on the static characteristics. Author

N69-30061# Technische Hochschule Carolo Wilhelmina Brunswick (West Germany). Institut fuer Stroemungsmechanik
AERODYNAMIC CHARACTERISTICS OF SLENDER WINGS IN GROUND PROXIMITY [AERODYNAMISCHE EIGENSCHAFTEN SCHLANKER FLUEGEL IN BODENNAHE]
K. Gersten and J. V. D. Declan 20 Sep. 1968 61 p refs In GERMAN; ENGLISH summary
(Rept-68/27) Avail: CFSTI

By extending classical slender body theory, the effect of ground proximity on aerodynamic characteristics of slender wings has been determined theoretically. Wings with arbitrary cross sections and with large thickness have been treated because thickness of wings near ground can have a considerable influence. The equation of the potential function has been solved by using the method of continuous distributions of vortices and sources, which are located either on the contour itself or on the spanwise chord. In order to check the theory, experimental investigations on a delta-wing, a wing-body combination, and a circular cone have been carried out. In the comparison between theory and experiment the thickness effects and the ground effects have been emphasized. The changes of the aerodynamic coefficients due to thickness as well as due to ground proximity are predicted fairly well by the theory. Author

N69-30067# Rutgers Univ., New Brunswick, N.J. Dept. of Mechanical and Aerospace Engineering.
EFFECT OF SHEAR FLOW ON AIRFOILS AND WINGS Final Report, 1 Jul. 1966–31 Jan. 1968
C. F. Chen Feb. 1968 14 p refs
(Contract DA-31-124-ARO(D)-387)
(AD-684935; TR-124-MAE-F) Avail: CFSTI CSCL 1/3

Conducted were theoretical studies of the following topics: a second order theory for airfoils in uniform shear flow; evaluation of the effect of flow shear on the induced drag of an elliptically loaded wing; a second-order theory for airfoils in nonuniform shear flow. Author (TAB)

N69-30080*# National Aeronautics and Space Administration Lewis Research Center, Cleveland, Ohio.
CHARACTERISTIC DESIGN STUDY OF MIXED-COMPRESSION TWO-DIMENSIONAL INLETS WITH LOW-ANGLE COWLS FOR THE MACH NUMBER RANGE 2.70 TO 1.80
Bernhard H. Anderson Washington Jul. 1968 37 p refs
(NASA-TN-D-5230) Avail: CFSTI CSCL 01A

An analytical study was performed to evaluate the effects of several design variables at off-design Mach numbers. Major improvements were realized in overall surface Mach number distributions at off-design conditions by decreasing the internal compression rate in two ways: (1) extending the overall supersonic

compression length to avoid surface inflection point, and (2) requiring greater compressive turning by the cowl lip shock. Decreasing the compression rate provided nearly equal cowl and centerbody Mach numbers and Mach number gradients on design. Author

N69-30083*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INFLATION AND PERFORMANCE OF THREE PARACHUTE CONFIGURATIONS FROM SUPERSONIC FLIGHT TESTS IN A LOW-DENSITY ENVIRONMENT
Charles H. Whitlock and Richard J. Bendura Washington Jul. 1969 53 p refs
(NASA-TN-D-5296) Avail: CFSTI CSCL 01C

Ten flight tests of modified-ringsail, disk-gap-band, and cross parachute configurations with deployment initiated at Mach numbers and dynamic pressures corresponding to conditions expected during entry into a Martian atmosphere have been completed. Comparison of flight results indicates that theoretical snatch force values were never exceeded when the deployment techniques of these tests were used. Opening loads showed no definite trend with Mach number. Values for filling times compared favorably with generally accepted empirical curves based on 15-percent geometric porosity. Canopy stability was good when Mach numbers were below 1.4 for the modified-ringsail and disk-gap-band configurations. At higher Mach numbers, one test of the disk-gap-band configuration showed canopy fluctuations. The cross-parachute canopies did not achieve a stable configuration during the data period. Comparison of the drag coefficients indicates that the cross parachute produced the highest values and the modified-ringsail values were slightly higher than those of the disk-gap-band configuration. Author

N69-30319# Boeing Co., Seattle, Wash.
REALITY OF TRANSONIC PROBLEMS
Paul Germain Apr. 1969 54 p refs Transl. into ENGLISH from French Rept.
(B-940) Avail: CFSTI

A state-of-the-art review is presented on the calculation of performance of an airfoil in the transonic mode and the design of an airfoil responding to certain predetermined conditions. It is concluded that approximate and provisional solutions reached by somewhat empirical methods have already been proposed. In addition it is stated that certain theoretical progress has been made: the transonic theory of small perturbations has been extended to the second order of approximation; an approximate method has been defined to study the first approximation in the physical plane; numerical and analog methods have been developed to study transonic flows by the hodograph method; and the behavior of sonic flow at infinity around any given profile is known. The unsolved problem of flow, subsonic at infinity, reaching supersonic velocities around the airfoil, with each supersonic region terminating by a finite shock wave is cited as difficult even as far as qualitative analysis. K.R.G.

02 AIRCRAFT

Includes fixed-wing airplanes; helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N69-29093# National Transportation Safety Board, Washington, D.C.
BRIEFS OF ACCIDENTS, 1968, No. 3, US CIVIL AVIATION
1968 151 p
(PB-182744) Avail: CFSTI CSCL 01B

The publication, containing reports of U. S. civil aircraft accidents, in brief format is issued monthly and includes those accidents analyzed and processed during the preceding month. The reports are reproduced directly from the coded record on magnetic tape by electronic data processing equipment. The cause factor, accident types, operational phases and kinds of flying contained in this report are tabulated. Author (USGRDR)

N69-29232*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
A FLIGHT INVESTIGATION OF A LIGHTWEIGHT HELICOPTER TO STUDY THE FEASIBILITY OF FIXED-COLLECTIVE-PITCH AUTOROTATIONS
Robert J. Pegg Washington Jun. 1969 17 p refs
(NASA-TN-D-5270) Avail: CFSTI CSCL 01C

A flight investigation of a lightweight teetering rotor helicopter was conducted to explore the limitations encountered in power-off flight with the collective pitch stick held in the trim level flight position. The results indicate that with the collective pitch stick fixed in the trim level flight position, autorotation is possible under selected conditions with attendant gains in helicopter performance. Aircraft vibrations limited successful use of this technique to airspeeds between 25 and 80 knots. Author

N69-29239*# National Aeronautics and Space Administration, Washington, D.C.
PROPELLER BALANCING DURING OPERATION [DOVAZOZANI VRTULI ZA PROVOZU]
Jiri Stateony Jun. 1969 12 p refs Transl. into ENGLISH from Zpravod. Vyzkumny a Zkusebni Letecky Ustav (Letnany) (Zech), v. 6, 1966 p 33–38
(NASA-TT-F-11411) Avail: CFSTI CSCL 01C

The design and operation of an apparatus for final propeller balancing during engine operation are described. This balancing is required after mounting in order to reduce vibrations which were not eliminated during production. Vibrations excited by propeller imbalance are eliminated by an equivalent mass-force imbalance. The vibrations introduced by mass, force, and aerodynamic imbalance are described. The theory of propeller balancing in a single plane is studied. The operation of the balancing apparatus is examined, and the indicated procedure is discussed. The described unit may also be used for balancing rotating masses in two planes. Author

N69-29254*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
INFLUENCE OF SECONDARY FORCES ON THE TAKEOFF AND LANDING CHARACTERISTICS OF A SHORT TAKEOFF AND LANDING (STOL) JET AIRCRAFT [O VLIYANII VTORICHNYKH SIL NA VZLETNO POSADOCHNYYE KHARAKTERISTIKI REAKTIVNOGO SAMOLETA KOROTKOGO VZLETA I POSADKI (SKVP)]
V. I. Surus Washington NASA May 1969 9 p refs Transl. into ENGLISH from the book "Samoletostroyeniye i Tekhnika Vozdushnogo Flota, Respublikanskiy Mezhvedomstvennyy Nauchno-Technicheskiy Sbornik" Khar'Kov, Khar'Kov State Univ. Press, no. 12, 1967 p 16–20
(Contract NASw-1692)
(NASA-TT-F-12181) Avail: CFSTI CSCL 01C

A theoretical investigation was conducted of the influence of secondary forces induced by the jets on the aerodynamic characteristics, and hence on the takeoff and landing characteristics

of STOL aircraft. Approximate formulas which take the secondary forces into account are derived and are used to calculate the aircraft velocity at the moment of separation from the runway, the minimum take-off distance, and the minimum time to separation from the runway. Author

N69-29264# Boeing Co., Seattle, Wash. Office of International Operations.

FLUTTER ANTICIPATION ON AIRPLANES WITH DRY FRICTION

Jacques Periaux et al Jan. 1969 18 p refs Transl. into ENGLISH from Rech. Aerospatiale (Paris), no. 125, Jul.-Aug. 1968 p 67–73

(F-252) Avail: CFSTI

The ground vibration tests of aircraft and the flutter calculations are based on the assumption of linearity, which is often inadequate due to dry friction in the controls' transmissions. Starting from an extremely simplified model, it is shown how the techniques used for the study of linear systems can be adapted to these airplanes. Author

N69-29394*# Techtran Corp., Glen Burnie, Md.

RECENT MEASUREMENTS OF JET AND COMPRESSOR NOISE. APPLICATION TO CALCULATION AND PREDICTION METHODS [RECENTES MESURES DE BRUITS DE JETS ET COMPRESSEURS. APPLICATION AUX METHODES DE CALCUL ET DE PREVISION]

M. Kobrynski Washington NASA Jun. 1969 20 p refs Transl. into ENGLISH from French conf. paper ICAS-68-40 Presented at the 6th Intern. Council of Aeron. Sci. Congr., Munich, 9-13 Sep. 1968

(Contract NASw-1695)

(NASA-TT-F-12245; ICAS-68-40) Avail: CFSTI CSCL 01A

These studies required special installations: anechoic chambers with inputs and outputs for air and gases, with test stands in ambient air. The experiments were conducted on jet and compressor models and on turbojets, on test benches and in aircraft, either as a fixed point or in flight. The results make it possible to propose methods for calculating the sound field received on the ground. Various types of silencers are under study, particularly for the Concord. The studies of compressors revealed the fine structure of sound, the effect of some parameters on the sound emission, and their relationship with the emitted acoustic power. Author

N69-29444# Aeronautical Systems Div., Wright-Patterson AFB, Ohio. Deputy for Engineering.

PROBABILISTIC DETERMINATION OF AIRCRAFT RESPONSE TO TURBULENCE AT LOW ALTITUDES Technical Report, May 1966–Nov. 1967

John A. Dutton and Gary J. Thompson Oct. 1968 151 p refs

(AD-685184; ASD-TR-68-39) Avail: CFSTI CSCL 1/3

The theory of the distribution of maxima exceedance statistics developed by S. O. Rice is combined with available information on atmospheric turbulence in an attempt to predict the statistics of aircraft responses. Details of the theoretical method are expounded, and the turbulence is assumed to be a Gaussian process to permit explicit calculation of the desired probability functions. Data from B-66 and F-106 gust investigations are combined with theoretical results to compute the statistics of maxima and exceedances for a variety of special cases. Predictions made using Gaussian assumptions disagree, in an apparently significant way, with empirically determined exceedance statistics. It is concluded that either the Gaussian assumption is not tenable, or the empirical data are inconsistent. Methods to utilize the actual distribution of turbulence are investigated. Straightforward approaches will probably not be practical unless the turbulence possesses a nearly Gaussian joint distribution for the velocity and the first two derivatives. Author (TAB)

N69-29446# Goodyear Aerospace Corp., Akron, Ohio.

TETHERED BALLOON HANDBOOK Final Scientific Report, 1 May–31 Dec. 1968

Philip F. Myers Dec. 1968 246 p refs

(Contract F19628-68-C-0311)

(AD-685183; GER-14142; AFCRL-69-0017) Avail: CFSTI CSCL 1/3

The Tethered Balloon Handbook is a single volume reference covering the history, development, applications, and listings of available modern equipment for tethered balloon activities of an engineering or scientific nature. Author (TAB)

N69-29637# Boeing Co., Seattle, Wash. Office of International Operations.

TESTING OF SELF-ADAPTING SYSTEMS ON THE MIRAGE 3

J. C. Pasrd Jan. 1969 20 p Transl. into ENGLISH from French conf. paper Presented at AGARD Symp. on Advanced Flight Control Concepts, Oslo, Sep. 1968

(C-153-1) Avail: CFSTI

The results of functional ground and flight tests of an electrohydraulic, tandem-type servo for directional control and of two yaw dampers (one active, one passive) are briefly discussed. K.W.

N69-29645# Advisory Group for Aerospace Research and Development, Paris (France).

THE AERODYNAMICS OF V/STOL AIRCRAFT

London May 1968 504 p refs Presented at a Lecture Ser. Sponsored by AGARD and the von Karmen Inst., Rhode-Saint-Genese, Belgium, 13-17 May 1968

(AGARDograph-126) Avail: CSFTI

An up-to-date account is presented of aerodynamic problems and requirements for V/STOL aircraft, including novel aerodynamic advances, areas for research and development, experimental and theoretical methods, and immediate as well as long-term prospects for V/STOL aircraft. The material is arranged under the following headings: (1) introduction to V/STOL aircraft concepts and categories; (2) characteristics and performance of pure and compound helicopters; (3) basic aerodynamics of convertible rotor/propeller aircraft, including hovering, vertical climb, forward flight, and operation in the STOL mode of VTOL aircraft; (4) aerodynamics of shrouded propellers; (5) turbojet/turbofan aircraft; (6) boundary layer and circulation control for STOL aircraft; (7) techniques for the aerodynamic testing of V/STOL models; and (8) flight testing and V/STOL handling requirements. K.W.

N69-29761# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.

NOISE STUDIES FROM THE FAN-IN-WING MODEL

G. Krishnappa Jun. 1968 21 p refs

(AD-684964; NAE-LR-508; NRC-10805) Avail: CFSTI CSCL 1/3

Some preliminary measurements of noise from a highly loaded fan-in-wing configuration are reported. Measurements of the spectra are presented for fan speeds of 7500, 9750, and 13,125 rpm (corresponding to tip Mach number 0.35, 0.45, and 0.62) at an angle of 20 deg. from the axis of the fan and at 5 ft from the inlet and efflux faces of the fan. The experimental results show a discrete peak at blade-passing frequency, superimposed on a broad band noise that extends from 1000 c/s to 15,000 c/s. An analysis

of the duct transmission of higher order modes at the above rotational speeds reveals high decay rates. This explains the absence of discrete tones at the harmonics of the blade-passing frequencies. The presence of high intensity broad band noise may be attributed to the turbulence in the wake and free stream turbulence ahead of the rotor blades. Author (TAB)

N69-29768# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE LONGITUDINAL STATIC STABILITY OF AIRCRAFT WITH TWO LIFTING WINGS
V. I. Korolev Oct. 1968 11 p Transl. into ENGLISH from the Book "Gidroaerodinamika Nesushchikh Poverkhnostey; Materialy Konferentsii" Kiev, Izd-Vo Nauk. Dumka, 1966 p 216–222
(AD-685482; FTD-HT-23-569-68) Avail: CFSTI CSCL 1/3

A study is made of the static stability of aircraft with two lifting wings, front and rear (a tandem system), spaced at a certain distance determined by the length of the aircraft fuselage. In the general case, wings may have different angles of attack, relative aspect ratio, chords, and relative distances from the ground. The combination of these elements and the position of the center of gravity to the length of aircraft are determined to insure the derivation of maximum restoring moments in the static deviation of the aircraft from the calculated position at a small angle. Author (TAB)

N69-29803# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
SYSTEM FOR AIRCREW FLIGHT EXTENSION AND RETURN
D. W. Rabenhorst Dec. 1968 29 p refs
(Contract NOw-62-0604-C)
(AD-685221; APL-TG-1040) Avail: CFSTI CSCL 13/12

A unique aircraft power distribution system concept has been recently developed. This power distribution system offers performance capabilities greatly in excess of present program objectives while maintaining competitive cost, weight, size, reliability, and simplicity. In this report basic elements of such a system and the various factors which would govern the selection of an actual operational configuration are described. This concept is called System for Aircrew Flight Extension and Return; the acronym SAFER describes the principal objective. Author (TAB)

N69-29849# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MEET AEROFLOT
V. Gavrilenko et al 26 Sep. 1968 74 p Transl. into ENGLISH of the Publ. "Znakomtes--Aeroflot" Moscow, Izd. Znaniye, 1968
(AD-685423; FTD-MT-24-254-68) Avail: CFSTI CSCL 1/2

The document is a non-technical summary of civil aviation in the USSR designed for popular reading, and contains four main sections. The role of aeroflot in the general transport system of the USSR; Aircraft of civil aviation; Organization of aviation engineering service and technical servicing of aircraft in civil aviation; Useful information for the air traveller. TAB

N69-29976# Army Foreign Science and Technology Center, Washington, D.C.
EKRANOPLANY: WINGED CRAFT OF THE FUTURE. AN AIR SLED-AMPHIBIAN FROM THE DESIGN BUREAU OF A. N. TUPOLEV
D. Pipko [1968] 26 p Transl. into ENGLISH from Nauka i Zhizn (Moscow), no. 1, 1968 p 32–41
(AD-685370; FSTC-HT-23-852-68) Avail: CFSTI CSCL 1/3

The speed of water transportation has been increased through the use of wingless ground effect vehicles which are supported on an air cushion slightly above the surface of the Earth. The Ekranoplane is a winged vehicle which operates in the same region but utilizes the principle of increased aerodynamic lift near the surface of the Earth for support. The advantage of the Ekranoplane over the wingless ground effect vehicle is that potentially higher speeds are possible with reduced fuel consumption. An explanation of the phenomenon of increased lift near the surface of the Earth is given, accompanied by graphs showing the influence of the flight altitude on drag and on the aerodynamic quality. Descriptions are given of experimental and projected Ekranoplanes, both in the Soviet Union and abroad. The economical advantages of the future employment of Ekranoplanes for passenger and freight traffic on sea and ocean routes are discussed. Construction details and performance characteristics of a gasoline-engine powered air sled-amphibian, capable of travel over snow or swampy surfaces are discussed. The craft is intended for economical transportation, particularly in snowy areas without road communications, and attained speeds of over 120 km per hours. The economy in fuel consumption is achieved through an aerodynamic hull design which aids in reducing friction forces. A provision is made for the installation of a more powerful engine. TAB

N69-30345# Boeing Co., Seattle, Wash. Office of International Operations.
ADAPTIVE CONTROL SYSTEMS
B. Hamel Jan. 1969 13 p refs Transl. into ENGLISH from French conf. paper Presented at AGARD Symp. on Advanced Control System Concepts, Oslo, Sep. 1968
(C-153-2) Avail: CFSTI

The flight characteristics of modern high-performance airplanes fluctuate considerably between flight configurations at low speed, low altitude and high speed, and high altitude. The consequence is that a linear piloting system with rigid adjustment is not very capable to control the airplane in a constant manner. In the existing conventional systems with programmed gain, gain programming proceeds from determinging the speed and the altitude. A simple rule for change of gain is chosen for technical and economical reasons. The results is an airplane damping, satisfactory for certain flight types, clearly insufficient for others. The importance of self-adapting systems is to provide the piloted airplane with good conditions of stability and satisfactory transitory responses in the entire flight domain. Author

N69-30351# Boeing Co., Seattle, Wash. Office of International Operations.
INFLUENCE OF SYSTEM RELIABILITY ON ACCIDENT RISKS DUE TO LOW FLIGHT QUALITIES
Jean-Claude L. Wanner Jan. 1969 9 p Transl. into ENGLISH from French conf. paper Presented at AGARD Symp. on Advanced Control System Concepts, Oslo, Sep. 1968
(C-153-3) Avail: CFSTI

The probabilities involved in accidents due to combinations of faulty equipment, breakdowns, and unfavorable atmospheric conditions are investigated, and methods to determine risks are discussed. It is stated that considerably more statistical data is needed than is presently available, and it is suggested that recorders be put on all commercial aircraft to obtain data. N.E.N.

N69-30381# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE BOUNDARY OF THE FANTASTIC
A. Molotkov Sep. 1968 11 p Transl. into ENGLISH from Sov. Voin (USSR), v. 49, no. 23, 1967 p 33–37
(AD-685066; FTD-HT-23-304-68) Avail: CFSTI CSCL 1/3

Aviation designers conceived the idea of constructing an aircraft in such a manner that its wings could vary their position at the desire of the pilot. When it is necessary to increase the speed - they are laid back toward the fuselage, and the aircraft becomes arrow-like, and when the speed is decreased, the wings again straighten out, creating considerably greater lift. In this case the supersonic craft let us say a fighter-interceptor, transforms into an inoffensive slowly moving aircraft. For such an aircraft, airfields with runways of several kilometers in length will not be needed.
Author (TAB)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N69-29290# Commissariat a l'Energie Atomique, Cadarache (France). Centre d'Etudes Nucleaires.
SIMULATION OF INCIDENTS IN SODIUM-HEATED STEAM GENERATORS BY MEANS OF ANALOG COMPUTERS. CARES PROGRAM. [SIMULATION D'INCIDENTS AU MOYEN DE CALCULATEURS ANALOGIQUES DANS DES GENERATEURS DE VAPEUR CHAUFFES AU SODIUM (PROGRAMME CARES)]
C. Trimouille and H. Cambe [1968] 52 p refs In FRENCH
Presented at Intern. Symp. on Analogue and Hybrid Computation Applied to Nucl. Energ., Versailles, France, 16 Sep. 1968
(CEA-CONF-1124; CONF-680941-5) Avail: AEC Depository Libraries

The development of an improved mathematical model for calculating the principal characteristics of the Na–water reaction in steam generators for Na cooled reactors is detailed. Equations are set up for Na loop pressure, and Na entry and exit heat balances; heat balance equations are listed for the H_2, Ar, and water loops. Use of the analog computer for solution to the equations is discussed. Simplified schematics of the physical system are shown; diagrams showing the steam generator and analog circuits are given. Couple curves generated from the analog simulation are included.
NSA

N69-29427*# Techtran Corp., Glen Burnie, Md.
MANUFACTURING FILE FOR STORAGE BATTERY CELL VR 3.5 DS [DOSSIER DE FABRICATION DE L'ELSMENT D'ACCUMULATEUR VR 3.5 DS]
Washington NASA May 1969 21 p Transl. into ENGLISH of French Rept. CNES-069
(Contract NASw-1695)
(NASA-TT-F-12194; CNES-069) Avail: CFSTI CSCL 10C

Design and test data on the leakproof cadmium-nickel type VR 3.5 DS cell are presented. This storage battery cell differs from the previous VR 3.5 D type by using thinner electrodes; less charge in the positive cells; cover with ceramic seal for leak proof closures; and different methods of adjustment for increased mechanical resistance. The purpose and structural materials of the component parts are discussed. Tests were performed during component manufacture, cell manufacture, and final electrical check.
Author

N69-29555*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECTS OF THERMAL-SHOCK CYCLING ON THIN-FILM CADMIUM SULFIDE SOLAR CELLS
John J. Smithrick Washington Jun. 1969 14 p refs
(NASA-TM-X-1819) Avail: CFSTI CSCL 10B

Thermal-shock cycling of Kapton, copper, and molybdenum substrate thin-film cadmium sulfide (CdS) solare cells was conducted in an inert atmosphere by heating the cells to 66°C (339°K) and dipping them into liquid nitrogen. The Kapton substrate cells split in the CdS and delaminated. The open-circuit voltage and fill factor did not change; the shortcircuit current and maximum power decreased in direct proportion to the area by delamination. The single copper substrate cell tested did not delaminate or degrade after 1352 cycles. The single molybdenum cell tested did not delaminate after 1352 cycles but did degrade;however, comparable molybdenum substrate cells degrade on shelf storage also. The mode of degradation under thermal shock cycling was different from that observed, by others, under thermal cycling more realistic earth orbit simulation.
Author

N69-29707*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
PRELIMINARY PERFORMANCE CHARACTERISTICS OF A GAS-BEARING TURBOALTERNATOR
James C. Wood, Martin E. Valgora, Roman Kruchowy, Joseph S. Curreri, Dennis A. Perz et al Henry B. Tryon Washington Jun. 1969 22 p refs
(NASA-TM-X-1820) Avail: CFSTI CSCL 10A

This report presents a preliminary evaluation of a Brayton cycle turboalternator using gas-lubricated bearings and operating on argon at a turbine inlet temperature of 1225°F (936°K). The turboalternator was operated successfully through steady-state and transient modes for 1165 total hours, during which time it was started and stopped 24 times. The alternator output was 8.9 kilowatts electric. The temperatures in the turboalternator did not exceed the predicted values when the turboalternator was operating at design conditions. The bearings always operated within the design clearance limits during both steady-state and transient testing. Largest clearance changes were experienced with the thrust bearings during full-load electrical transient tests.
Author

N69-29842# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL INVESTIGATION OF THE INFLUENCE OF BOUNDARY LAYERS AND CERTAIN OTHER EFFECTS ON THE CHARACTERISTICS OF AN MHD GENERATOR
A. E. Sheindlin et al Aug. 1968 31 p refs Transl. into ENGLISH of the publ. "Eksperimentalnoe Issledovanie Vliyaniya Pogranichnykh Sloev i Nekotorykh Drugikh Effektov na Kharakteristiki Mgd-Generatora" p 1–31
(AD-685536; FTD-MT-24-177-68) Avail: CFSTI CSCL 10/2

The paper deals with the results of research on the electrical characteristics of an MHD generator, carried out in a model power plant using the U-02 MHD generator. In this device was tested different types of MHD ducts which vary both in design and in the structural materials used for the electrodes and the insulating walls. As a result of this work the power of the generator was raised to 42 kW and the operating time was taken to 100 hours. The maximum power extracted from a single pair of electrodes has reached 2.5 kW and the current density at the electrodes is 2.5 A/sq cm (in the short-circuiting regime). A great deal of experimental data was accumulated during the development and testing of the duct designs, and the paper is devoted to an analysis of this information. The object of study is a Faraday-type MHD generator with segmented electrodes, operating in a subsonic gas-dynamic regime.
Author (TAB)

N69-29843# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

OPTIMUM GEOMETRIC RELATIONSHIPS IN A COAXIAL LINEAR INDUCTION AND MHD GENERATOR

N. M. Okhremenko et al Aug. 1968 27 p refs Transl. into ENGLISH of the publ. "Optimalnie Geometricheskie Sootnomeniya v Koaksyalnom Lineinom Induktsionnom Mgd-Generatore SM-107/174" USSR p 1/21

(AD-685523; FTD-MT-24-173-68) Avail: CFSTI CSCL 10/2

Mathematical treatment of design problems for the asynchronous coaxial MHD generator with liquid-metal (Na, K) working fluid and unilateral or bilateral excitation at outputs of 5kw-150mw. TAB

N69-29892# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

RAYLEIGH-TAYLOR INSTABILITY IN LIQUID-METAL SYNCHRONOUS MHD GENERATORS AND METHODS OF STABILIZING IT

K. I. Kim 30 Aug. 1968 19 p refs Transl. into ENGLISH from Neustoychivost Releya-Teilora v Zhidkomet. Sinkhronnykh Mgd Generatorakh i Sposoby Yeye Stabilizatsii (USSR)

(AD-685487; FTD-MT-24-174-68) Avail: CFSTI CSCL 10/2

Use of piston-type flow in liquid-metal MHD systems is proposed in order to counteract Rayleigh-Taylor instability. Two main advantages are cited: (1) difficulties connected with acceleration are excluded inasmuch as the generating of electrical energy is guaranteed basically because of the gas expansion in the generator duct itself; flow rate can be more moderate, impossible in systems with continuous flow and noticeably reduced hydraulic losses; (2) in view of the small contact surface between liquid metal and gas and the low coefficient of temperature transfer of gas, a lower temperature of the thermodynamic cycle can be selected independently of the temperature of hardening of the liquid metal, consequently, there appears a possibility of a noticeable increase of the thermal efficiency of the cycle; (3) the possibility appears of realizing the powerful effective and technically perfected synchronous principle of conversion of flow kinetic energy into electrical energy. These features show that a liquid-metal MHD system with piston flow and with electrical energy takeoff by the synchronous principle will be high-power. Author (TAB)

N69-29895# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE EFFECT OF PHASE CHANGED IN THE MINERALOGICAL COMPOSITION OF THE INORGANIC PART OF NATURAL CARBONS ON THE ELECTRICAL CONDUCTIVITY OF A COLLOIDAL PLASMA

N. A. Sinelnki 23 Aug. 1968 26 p refs Transl. into ENGLISH of the publ. "Vliyanie Fazovykh Izmenenii v Mineralogicheskom Sostave Neorganicheskoi Chasti Naturalnykh Uglei na Elektroprovodnost Kolloidnoi Plasmy" USSR p 1-18

(AD-685544; FTD-MT-24-182-68) Avail: CFSTI CSCL 10/2

The effectiveness of conversion of the thermal energy of coal into electrical (including the problems of conductivity, slag formation, drifts, erosion and corrosion of the MHD-duct) in considerable measure depends on the physical chemistry side of this question. For appraisal of the role of phase changes of minerals in the process of ionization of particles on overall physical chemistry investigation was conducted of colloidal plasma forming during the heating of an aerosol with a dispersed phase from the mineral part of certain coals of Siberia. The principal characteristic of colloidal plasma - its conductivity was determined and the physical chemistry processes occurring in its dispersed phase was investigated. Author (TAB)

N69-29921# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CALCULATION OF THE BOUNDARY LAYER AT THE ELECTRODE OF AN MHD GENERATOR OF VARIABLE CROSS SECTION

A. E. Yakubenko 26 Aug. 1968 20 p refs Transl. into ENGLISH from Raschet Pogranichnogo Sloya Na Elektr. Mgd Generatora Peremennogo Secheniya (USSR)

(AD-685529; FTD-MT-24-176-68) Avail: CFSTI CSCL 10/2

The paper gives a calculation of the boundary layer forming at the electrodes during the flow of the electrically conducting gas in an MHD generator duct, with a uniform magnetic field parallel to the electrodes and perpendicular to the flow. It is assumed that the inter-electrode distance changes linearly along the flow. If the boundary layers are assumed to be fairly thin and their electrical resistance is ignored, the flow in the region outside the boundary layer may be regarded as independent of that within it. The region outside the boundary layer will henceforth be referred to as the central region of the flow. On the basis of the assumptions made, the central region of the flow was calculated using a one-dimensional theory, ignoring the viscosity and thermal conductivity of the gas. The calculations were performed with an electrical conductivity coefficient dependent on temperature according to an exponential law. The calculations yielded figures for the dependence of the dynamic and thermodynamic characteristics of the flow in the central region on the co-ordinates along the axis of the duct, under conditions of a given pressure drop between the receiver and the outlet section of the duct, and for various values of the load parameter and the electrode aperture angle. These characteristics were used as boundary conditions in calculating the flow in the boundary layer near the electrodes. In the boundary layer flow calculations use was made of a boundary layer magnetohydrodynamic equation at low Reynolds numbers. Author (TAB)

N69-29924# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EXPERIMENTAL INVESTIGATION OF THE INFLUENCE OF THE EXCESS FUEL COEFFICIENT ON ELECTRICAL CONDUCTIVITY OF POTASSIUM-SEEDED HYDROCARBON-FUEL COMBUSTION PRODUCTS [EKSPERIMENTALNOYE ISSLEDOVANIYE VLIYANIYA KOEFFITSIYENTA IZBYTKA TOPLIVA NA ELEKTROPROVODNOST PRODUKTOV SGORANIYA UGLEVODO-RODNYKH TOPLIV S DOBAVKOY KALIYA]

S. A. Goldenberg et al 22 Aug. 1968 17 p refs Transl. into ENGLISH of a G.M. Krzhizhanovskiy Energy Inst. publication

(AD-685431; FTD-MT-24-181-68) Avail: CFSTI CSCL 10/3

Experimental investigation of conductivity of combustion products of hydrocarbon fuel in oxygen with potassium additive showed that, other things being equal, conductivity rises with increase of the excess fuel coefficient, C, and that for large values of C a tendency toward stagnation of the value of conductivity is observed. Author (TAB)

N69-29944# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MEASUREMENT OF TEMPERATURE OF PLASMA IN MHD-GENERATORS AND IN COMBUSTION CHAMBERS BY THE METHOD OF RECORDING THE ABSOLUTE INTENSITIES OF SPECTRAL LINES

S. Sucksewr 23 Aug. 1968 25 p refs Transl. into ENGLISH from Izmereniya Temperatury Plazmy v Mgd-Generatorakh i v Kamerakh Sgoraniya Metodom Registratsii Absolyutnykh Intensivnostei Spektralnykh Linii SM-109-94 (USSR) p 1-20

(AD-685488; FTD-MT-24-179-68) Avail: CFSTI CSCL 10/2

A discussion is given of the theory of measuring the temperature of plasmas in combustion chambers and MHD ducts by recording the absolute intensities (AI) of spectral lines with a large spontaneous emission coefficient (Aigi). The accuracy of the method and its suitability for measuring the temperature of plasmas in MHD ducts are analyzed. The paper describes the experimental set-up, which consists of a combustion chamber and an MHD duct, and presents a schematic diagram for temperature measurements by the AI method. The paper also describes how the accuracy of the method is checked by determining the normalized coefficient of emission of the recorded Na1 5890A and Na1 5896A line values. A schematic diagram is also given for measuring the surface temperature of electrodes in an MHD duct through the plasma by means of an optical pyrometer and using data obtained by recording the absolute line intensities and the absolute intensities of the continuum in the spectral region 6000-6500A. The author presents the results of plasma temperature measurements made by the absolute line intensity method and the results of electrode surface temperature measurements for different regimes of combustion chamber operation. Author (TAB)

N69-29977*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DYNAMIC PERFORMANCE ANALYSIS OF A FUEL-CONTROL VALVE FOR USE IN AIRBREATHING ENGINE RESEARCH

Peter G. Batterton and John R. Zeller Washington July 1969 29 p refs

(NASA-TN-D-5331) Avail: CFSTI CSCL 13K

The analysis of a fast-response fuel-control valve for use in turbojet engine research is presented. This analysis includes cases where the valve is (1) closely coupled to the engine spray nozzles, and (2) located some distance from the engine, thus requiring connection by a hydraulic transmission line. The analysis results in a complete nonlinear model and an equivalent linearized model for both cases. The dynamic performance of the analytical models is presented and compared against corresponding experimental fuel-flow response data. A discussion is included which demonstrates how operating conditions affect fuel-flow frequency response. Author

N69-29991*# Boeing Co., Seattle, Wash. Aerospace Systems Div.

DEVELOPMENT OF SOLAR PANEL SYSTEM FOR THERMALLY ANNEALING RADIATION DAMAGED SOLAR CELLS Final Report

Dec. 1968 37 p refs

(Contract NAS5-10445)

(NASA-CR-101687) Avail: CFSTI CSCL 10B

A design of solar panels is presented. The panels required a heating system and a means of switching the solar cells from their operating state to the annealing state, and vice versa. The work accomplished included: (1) development of a thermal-diffusion bonding process for attaching silver-mesh interconnectors to solderless, silver-titanium-contact silicon solar cells; (2) evaluation of possible heating methods by thermal analysis; and (3) the design and fabrication of a 1-sq-ft high-temperature solar cell panel. Thermal-diffusion bonding was used to join silver interconnectors to solar cells without degrading the performance of the solar cells. The bonds withstand over 600 grams in shear and peel loading before failure. Thermal shock to liquid-nitrogen temperature does not degrade the electrical or mechanical integrity of the joint. Photomicrographs of bonds show a diffusion of the silver interconnector into the silver contact of the solar cell. Author

N69-30038# Joint Publications Research Service, Washington, D.C.

WORKING OF HELIOSTATIONS DESCRIBED

M. M. Koltun 12 Jun. 1969 9 p Transl. into ENGLISH from Khim i Zhizn (USSR), no. 5, 1959 p 17-22

(JPRS-48222) Avail: CFSTI

The physics of converting solar energy into electrical power is analyzed, as well as several types of devices which are capable of accomplishing this transformation. At present, there are no efficient, inexpensive, and durable systems in operation, but a Soviet power plant is in the design phase and is to be constructed within the next few years. This installation is designed to output 2.2 million kW/hr per year, and the steam from the turbine generator will power an absorption refrigerator to produce 20 tons of ice per hour. The problems and shortcomings of such a multistage cycle system are briefly mentioned, followed by a discussion of an alternative technique utilizing thermocouples, which is less sophisticated but more efficient. This result is obtained because thermoelectric elements allow the most inefficient stage, steam, to be eliminated from the energy conversion cycle. Mention is also made of a solar electric power plant being developed for desert installation, in which parabolic mirrors are used as sun-ray concentrators. A.C.R.

N69-30188*# Radio Corp. of America, Princeton, N. J. Astro-Electronics Div.

THIN-FILM Cu–As PHOTOVOLTAIC SOLAR ENERGY CELLS Final Report

P. A. Crossley, R. B. Gill, A. Spielman, and M. Wolf 28 Aug. 1967 105 p refs

(Contract NAS3-8510)

(NASA-CR-72308) Avail: CFSTI

The resuls of experimental work aimed at improving device conversion efficiency are reported. Measurements of the optical and electrical properties of cuprous selenide layers, and electrical measurements on the barrier contact characteristics, were made. The operating characteristics of the cells are described, including the results of a stability testing program, and the development of a successful antireflection coat. Author

N69-30253# Naval Ship Engineering Center, Philadelphia, Pa.

A REVIEW OF THE STATE-OF-THE-ART OF FLUIDIC ANNUNCIATORS Final Report

Edward Wexler Feb. 1969 22 p refs

(AD-685650; NAVSECPHILADIV-C-21) Avail: CFSTI CSCL 13/7

The report covers the state-of-the-art of fluidic annunciator development with particular emphasis on applications to naval machinery control. Both in-house and private developments are discussed with specific examples relating to ship propulsion systems. Conclusions cover advantages of currently available annunciators. Recommendations for future development are also discussed. Author (TAB)

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also 05 Biotechnology.

N69-29068# Naval Submarine Medical Center, Groton, Conn. Medical Research Lab.

THE PERCEPTION OF PITCH IN A WHITE NOISE MASK

Alan N. Richards 10 Oct. 1968 18 p refs

(AD-684775; SMRL-548) Avail: CFSTI CSCL 5/10

The mel scale, relating subjective pitch in mels to physical frequency in cycles per second, is now commonly found in texts and handbooks in engineering psychology. It is usually derived from the psychophysical method known as bisection, in which the listener adjusts a variable frequency to sound half as high in pitch as a standard tone. The average subject will not, for example, adjust the variable to 500 for a standard of 1000 cycles per second. In this study mel scales were derived from fractionation data when the standard and variable tones were presented in each of three background noise conditions. The scale for tones in quiet differed in no essential manner from the generally accepted mel scale advanced by Stevens in 1940; however, upon the introduction of a wide-band masking noise, the shape of the mel function became more positively accelerated. In general, when holding the intensity of the masker constant, this acceleration is inversely related to the sensation level of the masker constant, this acceleration is inversely related to the sensation level of the experimental tones above masked threshold, and is not frequency dependent. Although the relationship is not dependent upon frequency per se, the magnitude of pitch shift increases with frequency. Author (TAB)

N69-29057# Naval Submarine Medical Center, Groton, Conn. Medical Research Lab.

AUDITORY FEEDBACK AND HELIUM-SPEECH Interim Report

James Willott (Conn. Coll.) and Russell L. Sergeant 18 Sep. 1968 12 p refs

(AD-684773; SMRL-544) Avail: CFSTI CSCL 17/2

Acoustic and intelligibility analyses were made of speech from five talkers breathing air or an HeO2 mixture, when their speech was or was not masked by loud noise of 95 decibels sound pressure level re .0002 microbar. Mean intelligibility scores were determined from responses by 28 listeners for both air and helium conditions when noise interfered with a talkers ability to hear his own speech. The average long-term power spectra of speech in air and speech in the helium-mix did not differ to an appreciable degree as had been expected. However, sound spectrograms for the helium-speech revealed upward frequency shifts as typically reported. But neither the average spectra nor the spectrograms of helium-speech and speech in air showed significant differences between talking in noise versus talking in quiet. It is concluded that alterations made to improve intelligibility while speaking in loud noise are not closely related to the acoustic variations analyzed in this investigation. Author (TAB)

N69-29058# Naval Submarine Medical Center, Groton, Conn. Medical Research Lab.

THE THRESHOLD OF THE STAPEDIUS REFLEX TO SELECTED ACOUSTIC STIMULI IN NORMAL HUMAN EARS

Lawrence J. Deutsch 24 Sep. 1968 34 p

(AD-684774; SMRL-546) Avail: CFSTI CSCL 6/16

The threshold sound pressure levels for the middle-ear stapedius muscle reflex in response to white noise (constant spectrum level), and to pure tones and narrow bands of noise in the regions of 2 and 4 kilocycles per second, were studied with the Zwislocki acoustic impedance bridge and an objective recording method. Means and the shape of the distributions were provided. Mean thresholds for noise were as low as 82 decibels above audiometric threshold. Reliability and stability were high. It was concluded that the method could be used for a variety of purposes in audiometry, clinical audiology, and physiological acoustics; and for such purposes this paper provides normative data from 30 normal-hearing young men. Author (TAB)

N69-29100# Naval Submarine Medical Center, Groton, Conn. Medical Research Lab.

THE INTELLIGIBILITY OF HELIUM-SPEECH AS A FUNCTION OF SPEECH-TO-NOISE RADIO Interim Report

Russell L. Sergeant and Christine L. McKay (Conn. Coll.) 31 Oct. 1968 12 p refs

(AD-684777; SMRL-555) Avail: CFSTI CSCL 17/2

Three experiments compared the intelligibilities of helium-speech and normal speech masked by loud noise. Recordings were made of 5 talkers reading intelligibility word lists. Several panels of listeners heard these recordings masked by different levels of background noise. In Experiment 1, a fatigue effect seemed at first to be present differentially for the helium-speech, suggesting that short-term auditory fatigue may occur with helium. However, Experiment 2, designed to observe the effect on intelligibility of time during listening session that material was heard, refuted the notion of short-term fatigue effects. Experiment 3 incorporated results of the first two experiments to evaluate the effect of introducing varied levels of noise upon intelligibility of helium-speech and normal speech when order of presentation of gas mix was minimized. Author (TAB)

N69-29119# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.

EFFECTS OF RADIATION ON THE URINARY EXCRETION OF FREE AMINO ACIDS IN THE RABBIT [EFFETS DE L'IRRADIATION SUR L'EXCRETION URINAIRE DES AMINO-ACIDES LIBRES DU LAPIN]

C. Valle, J. C. Huet, and G. Marble [1968 13 p In FRENCH Presented at the 1st European Congr. on Radiation Protection and Exhibition on Equipments Using Low Energy and Short Range Radiation Dosimetry, Menton, France, Oct. 1968

(CEA-CONF-1172; CONF-681013-12) Avail: AEC Depository Libraries

The results obtained in the study of the urinary excretion of free amino acids in rabbits exposed to 400, 600, 800, and 1000 rads of γ radiation from a ^{60}Co source were reported. Some results present analogies with those observed during accidental human irradiation. It is difficult to draw dose-effect relations of the results from this first study. Author (NSA)

N69-29147# Army Research Inst. of Environmental Medicine, Natick, Mass.

BIOMEDICINE PROBLEMS OF HIGH TERRESTRIAL ELEVATIONS

A. H. Hegnauer Jan. 1969 172 p refs Symp. held at Army Res. Inst. of Environ. Med. Natick, Mass., 16–17 Oct. 1967

(AD-682731; USARIEM-TR-68-50) Avail: CFSTI CSCL 6/18

The symposium was concerned with (a) the effects of climatic extremes upon the human subject and his performance, (b) mechanisms of acclimatization, and (c) providing the information required for the development of means for protection with minimal decrement of performance. This symposium was therefore organized to present extant knowledge of the biomedical problems engendered by the hypoxia of high terrestrial altitudes. Central to the purpose was the thought that by means of such presentation and discussion, not only would the present 'state of the art' be summarized, but also that the gaps in present knowledge would appear in bolder relief, thus revealing the most promising and profitable directions for future research. Author (TAB)

N69-29196*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A PROCESS FOR IMPRINTING MICRO LAGOON FIELDS IN PLASTIC SURFACES FOR USE IN CELL AND TISSUE CULTURE

Clarence D. Cone, Jr. and Edward N. Fleenor, Jr. Washington Jun. 1969. 33 p refs
(NASA-TN-D-5255) Avail: CFSTI CSCL 06C

The process involved the fabrication of a metal impression die possessing a raised image anvil of the micro lagoon field on its surface, and the impressment of the heated die into the surface of suitable plastic vessels. Details of the die fabrication process are given, including the techniques used for photo transference of the basic lagoon-field image to the metal die surface and the development of the anvil imprint image on the die surface by chemical etching. The process used for imprinting the lagoon-field image into the plastic culturing surfaces of various culture vessel types is also described. Photomicrographs of typical lagoon fields formed by the process are presented, along with an analysis of factors in the die-fabrication process which affect the dimensional accuracy of the resulting lagoons. Time-lapse studies of actual cell growth in lagoons produced by the impression process, using L-strain fibroblasts, indicate that the lagoons are of excellent optical quality and are very effective in preventing both the escape of cells from the lagoons and the intrusion of external cells into the lagoons. Author

N69-29259*# Techtran Corp., Glen Burnie, Md.
EXPERIMENTALLY PRODUCED MICROCEPHALY IN CAUDATA [UBER EXPERIMENTELL ERZEUGTE MIKROKEPHALIE BEI URODELEN]
Glen Tondury Washington NASA May 1969. 35 p refs Transl. into ENGLISH from Arch. Entwicklungsmech. Organ. (Germany), v. 136, 1937 p 529–562
(Contract NASw-1695)
(NASA-TT-F-12154) Avail: CFSTI CSCL 06C

Experiments were performed on *Triton alpestris*, *taeniatus* and *Amblystoma mexicanum* with the intent of answering the following questions: (1) Is it possible to create defects in the foregut and foregut tegmen by performing defect operations in the area of the blastopore pit? (2) How do such defects effect head development? (3) Is formation of a normal head with a brain and sense organs only dependent on the nature and extent of the underlying head mesoderm, or does it develop as a function of the development of a normal foregut, or do both of these, underlay and foregut, work together as head organizers? The defect operation along with removal of the dorsal-lateral, and ventral parts, resulted in a clear reduction of small celled mesodermal foregut tegmen material in 55% of all embryos. As a result of these post-operatively developed defects, embryos were developed which had defective head anlagen in 80% of all cases and normal head anlagen in 20%. Author

N69-29272*# Techtran Corp., Glen Burnie, Md.
CONSTRICTION AND SECTION EXPERIMENTS WITH ANURAN EMBRYOS [SCHNURUNGS- UND DURCHSCHNEIDUNGSVERSUCHE AM ANURENKEIM]
G. A. Schmidt Washington NASA May 1969. 50 p refs Transl. into ENGLISH of Arch. Entwicklungsmech. Organ. (Germany), v. 129, 1935 p 1–44
(Contract NASw-1695)
(NASA-TT-F-12153) Avail: CFSTI CSCL 06C

Constriction and section experiments were designed to show that, in anurans just as in urodelans, the gastrula is still capable of making extensive adjustments and that it is not yet finally and irrevocably determined in its parts. Strong constrictions of anuran embryos at different stages of their development resulted in double formations, normal, well proportioned twins, or deformed though whole formations. After the neural plate has developed, the embryo is finally determined in its parts and constrictions produce only semi-formations. Experimental results are also affected by the constriction angle. Section experiments produced the same results. Author

N69-29289*# Ohio State Univ. Research Foundation, Columbus, Ohio. Acarology Lab.
DETERMINATION OF MINIMUM CONCENTRATIONS OF ENVIRONMENTAL WATER CAPABLE OF SUPPORTING LIFE Semiannual Report, 1 Nov. 1968–30 Apr. 1969
G. W. Wharton 10 Jun. 1969. 93 p refs
(Grant NGR-36-008-015; RF Proj. 1858)
(NASA-CR-101557; Rept-10) Avail: CFSTI CSCL 06C

As part of the continuing work on this project, a systematic analysis was made of the exchange of water between a mite *Leelaps echidnina* and the surrounding vapor. The water exchange rates were determined from observations of the water mass and tritium content of the mite following a step change in the environmental water balance parameters. The resulting change in water content was shown to be a first order rate process according to the theory of surface limited diffusion from solids. This model was further developed to relate the observed tritium content and specific activity to the total transpiration of water from the body fluids and the total sorption of water from vapor, respectively. The components of water exchange were hypothesized to include bulk flow, metabolic production and loss, diffusion, and the little understood active transport pump. The variations of permeability of the water exchange barrier were tentatively associated with the diffusion through the tracheal system. Author

N69-29347*# Stanford Univ., Calif. Biomechanics Lab.
TRANSMISSION CHARACTERISTICS OF DISTENSION, TORSION AND AXIAL WAVES IN ARTERIES
William E. Moritz (Ph.D. Thesis) May 1969. 90 p refs
(Grant NGR-05-020-223)
(NASA-CR-101582; SUDAAR-373) Avail: CFSTI CSCL 06P

Experiments were conducted using anesthetized, mature, male mongrels of unknown age, weighing between 20 and 40 kg and lying in a supine position. Complex Fourier analysis and the interference of wave reflections were eliminated by the use of small amplitude, finite trains of sine waves. The induced wall displacements were monitored by a pair of electro-optical tracking units equipped with a lens system that allowed for a resolution of 2×10^{-4}cm. Wave transmission data were also acquired on the effect of varying the arterial pressure, the initial stretch and the surrounding medium of the vessel, together with the signal amplitude. The results indicate that the artificial pressure wave is non-dispersive with a speed of about 11 m/sec, while the torsion and axial waves are mildly dispersive with speeds of 18-24 and 25-35 m/sec, respectively, for frequencies from 20 to 100 Hz. A discrepancy indicative of anisotropic wall behavior was evident between the experimental results and those predicted by an isotropic model. A.C.R.

N69-29380 Oklahoma Univ., Norman.
THE EFFECTS OF NOISE, AIR IONS, AND ELECTRIC FIELDS ON LIVING SYSTEMS
Adil M. Mayyasi (Ph.D. Thesis) 1968. 167 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-17593

Experimental animals (400 King-Holtzman hybrid breed of rats, 200 males half young and half adult and 200 females half young and half adult) were subjected to three environmental conditions: noise, negative air ions, and positive direct electric fields. This study consisted of two experiments, one of which involved exposing rats to two levels of noise and three levels of negative air ion concentrations. The other experiment involved exposing rats to two levels of noise and three levels of electric field intensity variations. The data collected consisted of the time and error scores (average value of 10 trials for each rat) of rats running a modified Lashley left–right maze with an escape from water motive. A randomized complete-block-design with repeated measures was

selected for statistical treatment by analysis of variance. In the cases where significant interaction terms appeared with significant main effects an additional statistic (Newman–Kauls) was used to facilitate interpretation of the main effects. Dissert. Abstr.

N69-29372*# Texas Women's Univ., Research Inst., Denton. Nelda Childers Stark Lab. for Human Nutrition Research.
THE EFFECT OF SPACE FLIGHT ON BONE DEMINERALIZATION
Pauline Beery Mack May 1969 159 p refs
(Contract NAS9-3687)
(NASA-CR-99696) Avail: CFSTI CSCL 06P

Experiment M–6 was designed to determine the extent of bone mass loss experienced during space flight and the rate of recovery of bone mass postflight. The method used in these investigations consisted of radiographic bone densitometry, with the crew members of Gemini flights 4, 5, and 7 serving as subjects. Calibrated and standardized radiographs were made at various times both preflight and postflight. By radiographing anatomical sites with a limited amount of soft tissue, the X-ray image of the bone was maximized. The radiographs were analyzed by a special analog computer to determine X-ray absorbency; the data were reported in terms of changes in X-ray equivalent calibration wedge mass which could be converted to changes in calcium hydroxyapatite, the chief component of skeletal mineral. Decreases in X-ray absorbency indicated a decrease in bone mass; increases indicated bone mass recovery. Author

N69-29435# American Inst. for Research, Pittsburgh, Pa.
DEVELOPMENT OF A TAXONOMY OF HUMAN PERFORMANCE: A REVIEW OF THE FIRST YEAR'S PROGRESS
Edwin A. Fleishman, Robert G. Kinkade, and Armand N. Chambers Nov. 1968 59 p
(Contract F44620-67-C-0116; ARPA Order 1032)
(AD-684583; AFOSR-69-0657TR; AIR-726-11/68-TPR1; TPR-1) Avail: CFSTI CSCL 5/10

The report briefly describes technical progress during the first year of a five year project to develop and verify a taxonomic system for the classification of human task performance. During this initial year, the major efforts on the project proceeded along four lines of activity: (1) review of previous taxonomic efforts, (2) development of an integrative model, (3) development of provisional classification schemes, and (4) development of a human performance data base. Previous taxonomic efforts were reviewed to provide guidelines and suggest approaches for the development of classification systems. An integrative model was developed to indicate which areas had to be taken into account in the development of a comprehensive task taxonomy. A provisional classification scheme, based on human abilities identified in earlier correlational studies, was developed to indicate the feasibility of using such an approach and to isolate some of the practical problems that might be encountered in the development of a taxonomy. Work on another provisional classification scheme, based on observable characteristics of tasks, has been initiated. The requirements of a human performance data base were defined to provide a resource and a research tool for testing provisional classification systems being developed. Author (TAB)

N69-29448# Oregon Univ., Eugene.
CHARACTERISTICS OF MATRIX TASKS EMPLOYED IN TASK-DIRECTED LEARNING
Fred R. Fosmire, Forrest L. Brissey, and Carolin S. Keutzer May 1968 31 p refs
(Grant AF-AFOSR-1055-66)
(AD-684585; AFOSR-69-0607TR) Avail: CFSTI CSCL 5/10

A general purpose of Task-Directed Learning (TDL) is to provide opportunities for participants in decision-making groups to learn something about the nature of complex interpersonal processes. A closely related objective is that the participants acquire a higher level of competence in the management of interpersonal relations. A key assumption in the TDL program is that the effectiveness of the group will increase as the individuals gain knowledge about group process and grow in interpersonal competence. For long-term working arrangements, there seem to be two separate and necessary components of group effectiveness: (1) technical competence in achieving the solution to the problem confronting the group at the outset, and (2) social reinforcement for members who participate in group decision-making. Author (TAB)

N69-29466 Stanford Univ., Calif.
EFFECTS OF VISCOSITY AND EXTERNAL CONSTRAINTS ON WAVE TRANSMISSION IN BLOOD VESSELS
Everett Jones (Ph.D. Thesis) 1968 157 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-237

The propagation of sounds and pulse waves within the cardiovascular system is subject to strong dissipative mechanisms. To investigate the effects of viscosity on dissipation as well as dispersion of small pressure signals in arteries and veins, a parametric study was carried out. A linearized analysis of pressure waves in a cylindrical membrane that contains a viscous fluid and whose wall is isotropically viscoelastic indicates that there are two families of axisymmetric waves: a family of slow waves and one of fast waves. It is shown that the faster waves are more sensitive to variations in the elastic properties of the medium surrounding the blood vessels. At high Reynolds numbers the attenuation due to fluid viscosity over a fixed length is found to be substantially greater for the fast waves than for the slow waves. At very low Reynolds numbers the effects of attentuation are reversed. Dissert. Abstr.

N69-29582# Army Aeromedical Research Unit, Fort Rucker, Ala.
AN EVALUATION OF OPHTHALMIC PLASTIC (CR-39) LENSES IN THE US ARMY AVIATION ENVIRONMENT
John K. Crosley, Robert W. Bailey, and Frank H. Fischer Feb. 1969 24 p refs
(AD-684371; USAARL-69-3) Avail: CFSTI CSCL 17/8

Thirty rated U. S. Army aviators with various types of refractive errors were selected to wear-test both clear and tinted plastic (CR-39) ophthalmic lenses for a period of six months. Subjective evaluations were made in the areas of impact resistance, scratch resistance, weight, optical clarity, comfort, cleaning ease, resistance to breakage, and accumulation of foreign material. User acceptance was quite good. Lens scratching was not found to be a significant problem. TAB

N69-29609# Army Biological Labs., Fort Detrick, Md.
APPLICATION OF THE HIGH-FREQUENCY ELECTRICAL CONDUCTIVITY METHOD FOR THE STUDY OF ADSORPTION PROPERTIES OF IRRADIATED PROTEINS
V. K. Trach et al 1969 9 p refs Transl. into ENGLISH from Russian publ.
(AD-685402; Trans-2411) Avail: CFSTI CSCL 6/18

The method devised by the author makes it possible to estimate the adsorptive properties of proteins by determining the temperature coefficients of the high-frequency electrical conductivity of their solutions. Author (TAB)

N69-29610# Kobe Univ. (Japan). Dept. of Physiology.
STUDIES OF THE MAMMALIAN BRAIN FUNCTION IN VITRO Annual Report, 3 Sep. 1967–Sep. 1968

Isamu Suda. San Francisco, Army Research and Develop. Group (Far East) 23 Jan. 1969. 15 p.
(Grant DA-CRD-AG-S92-544-67-G52)
(AD-684957; J-293-4) Avail: CFSTI CSCL 6/16

Viability of the frozen cat brain at -60C was studied by electrocorticograms, spontaneous single nerve cell discharges, light and electronmicroscopic examination. The brain which had been perfused with 4% dextran Hanks solution in situ was isolated and cryoprotective agent was added in the perfusate. Thereafter it was frozen slowly and stored at -60C for 28 days. Author (TAB)

N69-29612# Shuford-Massengill Corp., Lexington, Mass.
ITEM ANALYSIS BASED ON CONFIDENCE RESPONSES
Emir H. Shuford, Jr. and H. Edward Massengill. Mar. 1969. 49 p. refs.
(Contract F44620-69-C-0068; ARPA Order 833)
(AD-685182; SMC-R-17; AFOSR-69-0408TR) Avail: CFSTI CSCL 5/10

In examining the behavior of a group of subjects with respect to one test item, a distribution of confidence is obtained for each answer to the item. Empirical confidence distributions are analyzed for the responses of 98 students to 16 four-alternative items. Techniques are derived for computing both a difficulty index and a validity index from confidence data. Two graphical techniques are devised and applied to 16 items to indicate the ability of these items to discriminate between the better and poorer students. One graphical technique compares the confidence distributions for each of the possible answers for the upper and lower subjects while the other technique compares the frequency of occurrence of various states of knowledge in the upper and lower groups. Author (TAB)

N69-29613# Oregon State Univ., Corvallis.
INORGANIC FLUORIDE PROPELLANT OZIDIZERS. VOLUME 2: EFFECTS UPON MICROORGANISMS, FISH, AND PLANTS Final Report, 15 May 1966–30 Jun. 1967
Frank N. Dost, D. J. Reed, and C. H. Wang. Wright-Patterson AFB, Ohio. AMRL Nov. 1968. 71 p. refs.
(Contract AF 33(615)-1767)
(AD-684176; AMRL-TR-66-187-Vol-2) Avail: CFSTI CSCL 6/20

The effects of the inorganic fluoride oxidizing agents, chlorine trifluoride, chlorine pentafluoride, bromine pentafluoride, oxygen difluoride, nitrogen trifluoride, and tetrafluorohydrazine, upon selected species of microorganisms, fish, and plants were studied. In acute exposures of less than 1 hour, the interhalogens, as gases, are destructive to plants at atmospheric concentrations of 10-30 ppm, and in aqueous solution, are lethal to fish and microorganisms at concentrations of 10-25 micrograms fluoride per milliliter. The latter effects result from formation of inorganic acids and various oxidizing species, either of which are lethal alone and which can be neutralized by basic compounds and reducing agents, and by filtration through soil. Oxygen difluoride is toxic to plants at concentrations in air as low as 1.5 ppm over a 30-minute exposure period, but has no effect upon aquatic species. Nitrogen trifluoride and tetrafluorohydrazine are nearly innocuous to nonmammalian organisms. Author (TAB)

N69-29619*# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
DIRECT DETERMINATION OF DISTENSIBILITY OF THE LEFT VENTRICLE OF THE HEART UNDER IN VIVO CONDITIONS
William J. Astleford. Mar. 1969. 54 p.
(Grant NGR-05-020-223)
(NASA-CR-101581; SU-DAAR-372) Avail: CFSTI CSCL 06P

An attempt was made to obtain quantitative information on the effective material properties of the in vivo canine cardiac muscle through distensibility measurements. In addition, the frequency spectra of intravascularly recorded heart sounds were obtained. As part of a systematic effort to evaluate the accuracy of various possible mathematical models, a number of animal experiments were devised which should allow for a more direct determination of the heart's mechanical behavior. The governing equations and boundary conditions pertaining to the distensibility of the left ventricle are given. The ventricle is assumed to behave like a thick-walled spherical shell. Surgical preparations, instrumentation, and data acquisition and reduction used in the measurements are explained. These direct measurements of the distensibility established that the material properties of the left ventricular wall vary with the phase of the cardiac cycle and are frequency dependant within the ejection phase of systole. K.W.

N69-29627# School of Aerospace Medicine, Brooks AFB, Tex.
RESPONSE OF NORMAL MAN TO GRADED EXERCISE IN PROGRESSIVE ELEVATIONS OF CARBON DIOXIDE, 19 Jul.–24 Sep. 1967
Stuart J. Menn, Richard D. Sinclair, and B. E. Welch. Dec. 1968. 23 p. refs.
(AD-685271; SAM-TR-68-116) Avail: CFSTI CSCL 6/19

Trained volunteers performed steady-state moderate exercise (one-half of maximum VO2) and heavy exercise (two-thirds of maximum VO2) in 0, 8, 15, 21, and 30 mm Hg PICO2 for 30 minutes on a bicycle ergometer. At CO2 levels of 8 and 15 mm. Hg, no difficulty was encountered by the subjects. The higher levels of hypercapnia caused some respiratory symptoms of air-hunger and intercostal muscle pain, but were of mild enough degree to permit all subjects to complete the exercise. Incremental exercise up to workloads producing maximum VO2 was also performed. The tolerance at maximum exercise in 21 mm. Hg PICO2 resembled that at two-thirds workload in 30 mm. Hg PICO2. VE during maximum exercise did not vary with the level of inspired CO2, whereas at submaximal workloads, VE increased as PICO2 increased. At two-thirds and maximum workloads, VCO2 during exercise fell progressively with increasing PICO2. The ineffective CO2 removal is explained by the decreased alveolar-inspired CO2 gradient with increasing PICO2. Inadequate elimination of CO2 caused respiratory acidosis to be superimposed on the metabolic acidosis normally present during exercise. Author (TAB)

N69-29649*# Aztec School of Languages, Maynard, Mass. Research Translation Div.
ON THE ANALYSIS OF VISUAL PERCEPTIONS [ZUR PSYCHOPHYSIK DES SEHRAUMS. (THEORETISCHE BEDEUTUNG DES ZWEI KOMPONENTENSATZES)]
E. R. Jaensch. Washington, NASA, Jun. 1969. 30 p. refs. Transl. into ENGLISH from Z. Psychol. (Leipzig), Suppl. v. 4, pt. 1, 1929 p. 321–352
(Contract NASw-1692)
(NASA-TT-F-12101) Avail: CFSTI CSCL 06E

A theoretical dissertation on the nature of vision in light of recently established philosophical-methodological tenets is presented. The goal is to question findings (as well as methods and assumptions thereby employed) of neuroanatomical research on stimulation received by the retina, and the translations of it by the brain into impulses leading to behavior. Author

N69-29721# Naval Medical Research Inst., Bethesda, Md.
SENSORY DEPRIVATION (SLEEP SATURATION) AND PERFORMANCE Interim Report

Thomas I. Myers Oct. 1968 21 p refs
(AD-684074; MF12-524-003-1008-2; Rept-2) Avail: CFSTI CSCL 6/19

Experiments on the effects of sensory deprivation upon performance are summarized, and data and speculation presented to the effect that long term sensory deprivation may induce a state of sleep saturation entailing both a slowing of cortical activity and a resistance to drowsiness normally evident, for example on a vigilance task. Author (TAB)

N69-29723*# National Aeronautics and Space Administration, Ames Research Center, Moffett Field, Calif.
TOXICITY PROBLEMS IN PLASTIC HARDWARE DESIGNED FOR BIOLOGICAL SPACE-FLIGHT EXPERIMENTS
Richard Willoughby Washington Jun. 1969 7 p refs
(NASA-TM-X-1818) Avail: CFSTI CSCL 06C

In the development of hardware for biological space flight, various plastic materials were found to be toxic to sea urchin sperm and unfertilized eggs. Glass control chambers were not. Acrylic and polycarbonate plastics were tested as material for the hardware body, while fluorocarbon elastomer rubber, nitrile, three silicone rubbers, butyl rubber, and ethylene propylene were tested as O ring materials. Fertilized frog eggs were found to be compatible with ethylene propylene and acrylic plastic after careful treatment, principally outgassing by vacuum exposure, but no treatment was discovered which would sufficiently detoxify plastic hardware so that it would maintain sea urchin sperm and unfertilized eggs. Author

N69-29732# Naval Research Lab., Washington, D.C.
FUNGUS-INHIBITIVE COATINGS IN A JUNGLE ENVIRONMENT Final Report
F. T. Brennan, J. D. Bultman, and J. M. Leonard Feb. 1969 16 p refs
(AD-684764; NRL-6849) Avail: CFSTI CSCL 6/6

The ability of ten candidate fungicides, singly and in combination, to suppress fungal growth on a variety of organic coatings under natural, tropical conditions was investigated. After 1 year of exposure, substantial protection for the susceptible coatings was afforded by copper-8-quinolinate and binary mixtures of p-toluenesulfonamide with copper-8-quinolinate and phenylmercuric pithiate in fairly low concentration. At a higher concentration, p-toluenesulfonamide provided good protection for the susceptible coatings, while its n-ethyl derivative was less effective and its n-cyclohexyl derivative was almost inert. At an intermediate concentration, 2,3-dichloro-1,4-naphthoquinone and p-chlorophenoxyacetic acid provided effective protection for the susceptible coatings. None of the eight binary mixtures tested showed any evidence of synergism. The results confirm those obtained from earlier exposure programs; which showed that p-toluenesulfonamide is effective at higher concentrations in providing protection against fungal infestations. It was observed, however, that at very low levels this material may act as a growth promoter. Author (TAB)

N69-29740# Ohio State Univ. Research Foundation, Columbus.
ANALYSIS OF VISUAL AND PUPILLARY FUNCTIONING Final Comprehensive Report, 1 Jul. 1967–31 Dec. 1968
Torrence A. Makley, Jr. and William R. Bierdorf Jan. 1969 15 p
(Contract DADA-17-67-C-7165)
(AD-684362; Rept-3) Avail: CFSTI CSCL 6/16

To determine the site (or sites) of adaptation in the human eye, the components of the human electroretinogram were separately analysed by the incremental threshold technique at various levels of light adaptation and in dark adaptation. The human a-wave was found to adapt over at least three log units and was still not saturated at the highest adaptation tested. To develop an inexpensive method of recording human pupillary dilation and constriction, the c-wave of the electroretinogram was investigated. An inexpensive infrared electronic pupillograph was developed for the measurement of pupillary responses. Author (TAB)

N69-29751*# Martin Marietta Corp., Denver, Colo.
A PARAMETRIC STUDY TO DETERMINE TIME-TEMPERATURE-VACUUM RELATIONSHIPS FOR STERILIZATION OF TERRESTRIAL SPORES, PHASE 2 Summary Report
James A. Brierley Jun. 1969 37 p
(Contract NAS9-9261)
(NASA-CR-101701; MCR-69-289) Avail: CFSTI CSCL 06C

The results of a parametric study to determine time-temperature-vacuum relationships for sterilization of terrestrial bacterial spores are presented. Spores of *Bacillus* sp. G2, *Bacillus subtilis* var *niger*, and *Clostridium sporogenes* were exposed to temperatures of 100°, 105°, 110°, 115°, and 120°C at vacuum (10^{-6} torr) and atmospheric pressure for periods of 1, 4, 8, and 16 hours. The data were used to determine the D-values for the test spores at the test and control conditions. The vacuum increased the rate of spore death for *Bacillus* sp. G2 and *B. subtilis* spores at all test temperatures. The spores of *Cl. sporogenes* were more resistant to heat within the vacuum at 100°, 105°, and 110°C, but they showed no detectable heat resistance within the vacuum at 115° and 120°C. The data indicated that temperatures above 110°C, even in the vacuum environment, need to be used for sterilization. Author

N69-29788# Joint Publications Research Service, Washington, D.C.
CHEMISM AND PHYSICOCHEMICAL PROPERTIES OF PROCESSES OF MICROBIOLOGICAL OXIDATION OF PETROLEUM HYDROCARBONS
V. I. Karban et al. 3 Jun. 1969 44 p refs Transl. into ENGLISH from USP. Khim. (Moscow), v. 38, no. 3 1969 p 539–559
(JPRS-48150) Avail: CFSTI

The article presents a survey of literature on the microbiological synthesis of protein substances from petroleum hydrocarbons. A general description is given of the process and the conditions of its occurrence, as well as the chemical mechanism of the microbiological oxidation of aliphatic, aromatic, and heterocyclic hydrocarbons. Particular attention is given to physiocochemical and topochemical peculiarities of the process. It is shown that from the physiochemical viewpoint the process under consideration resembles emulsion oxidation of hydrocarbons. Author

N69-29841# Army Biological Labs., Fort Detrick, Md.
THE SECOND ALL-UNION CONFERENCE ON THE APPLICATION OF RADIOELECTRONICS IN BIOLOGY AND MEDICINE
Yu. B. Mandeltsval Jul. 1968 4 p Transl. into ENGLISH from Med. Radiol. (Moscow), v. 7, no. 8, 1962 p 100–101
(AD-685373; Trans-918) Avail: CFSTI

At 11 sectional meetings, more than 100 reports were made. One of the sections was devoted to electronic equipment in physiological research using isotopes. Author (TAB)

N69-29847# Federal Aviation Administration, Oklahoma City, Okla. Office of Aviation Medicine.
ASSESSMENT OF THE BROCA-SULZER PHENOMENON VIA INTER- AND INTRA-MODALITY MATCHING PROCEDURES: STUDIES OF SIGNAL-LIGHT BRIGHTNESS
Mark F. Lewis and Henry W. Mertens Oct. 1968 10 p refs
(FAA-AM-68-27) Avail: CFSTI

This study was concerned with the effect of method of measuring brightness and with the effect of adaptive state of the eye on the Broca–Sulzer phenomenon. Subjects adjusted the luminance of test flashes 1 to 1000 msec. in duration to match either the loudness of a 500 msec. comparison tone (1000 Hz) or the brightness of a 500 msec. comparison flash. Comparison tone loudness were 75, 86, and 97 dB. Comparison flash luminances were 10, 100, and 1000 mL. In the light-adapted condition, a 1.5 sec. adapting flash was presented 2.5 sec. before the comparison flash. No adapting flash was presented in the dark-adapted condition. The Broca–Sulzer effect appeared only with the highest comparison stimulus intensities in both crossmodality matching and brightness matching conditions. An interaction found between method of measuring brightness and adaptive state was also discussed. Author

N69-29872# Naval Submarine Medical Center, Groton, Conn. Medical Research Lab

STEREOSCOPIC AND RESOLUTION ACUITY WITH VARYING FIELD VIEW

Saul M. Luria 6 Dec. 1968 11 p refs

(AD-685229; SMRL-557) Avail: CFSTI CSCL 6/16

Resolution and stereoscopic acuity were measured while the field of view was varied in size--without, however, obstructing the targets for either eye. Resolution acuity showed no marked or regular changes, but stereoacuity was progressively reduced as the field of view was constricted. This supports the hypothesis that the sharp decline in stereoacuity is due to loss of peripheral visual stimuli and suggests that the introduction of such cues underwater should improve stereoacuity. Several possible explanations of the phenomenon are discussed. Author (TAB)

N69-29898# Centre d'Etudes de Physiologie Nerveuse et d'Electrophysiologie, Paris (France).

NERVOUS PROCESSES UNDERLYING BEHAVIOUR AND LEARNING Final Scientific Report, 1 May 1967–30 Apr. 1968

A. F. Fessard (Coll. de France) Apr. 1968 11 p

(Grant AF-FOAR-67-40)

(AD-684734; AFOSR-69-0580TR) CSCL 6/3

The aim of the research has been to evaluate the involvement of different cortico-subcortical structures in certain aspects of sleep, pain, and learning. Author (TAB)

N69-29901# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

BIOLOGICAL ACTION OF HIGH-ENERGY PROTONS, VOLUME 1

Yu. G. Grigoreva Oct. 1968 338 p refs Transl. into ENGLISH of the book "K Otsenke Radiatsionnoy Opasnosti Kosmicheskikh Poletov" Moskva, Atomizdat, 1967 508 p

(AD-685622; FTD-MT-24-150-68-Vol-1) Avail: CFSTI CSCL 6/18

This monograph deals with radiobiological problems which must be solved before man can master outer space. It deals in particular with the immediate and remote effects of ionizing radiation on man. It consists of seven chapters, some of which contain several separate articles. These are by various authors who cite the results of their own experiments and also refer very extensively to other investigations, both Soviet and foreign. These articles are consolidated under the following main headings: Physical aspects of radiation safety of space flight; Biological foundations for radiation safety of space flights; Model radiobiological investigations of the action of high-energy protons; Biological action of protons on mammals and birds; Radiobiological effects of the action of protons on plants; Clinico-physiological observations of persons working on accelerators; Prophylaxis and therapy of proton injuries; Radiobiological materials as the basis for the local protection of astronauts. TAB

N69-29902# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

BIOLOGICAL ACTION OF HIGH-ENERGY PROTONS, VOLUME 2

Yu. G. Grigoreva Oct. 1968 320 p Transl. into ENGLISH of the book "K Otsenke Radiatsionnoi Opasnosti Kosmicheskikh Poletov" Moskva, Atomizdat, 1967 508 p

(AD-685486; FTD-MT-24-150-68-Vol-2) Avail: CFSTI CSCL 6/18

For abstract, see N69-29901.

N69-29907# Federal Aviation Administration, Oklahoma City, Okla. Office of Aviation Medicine.

IMPACT INJURY TO THE PREGNANT FEMALE AND FETUS IN LAP BELT RESTRAINT

Richard G. Snyder, Clyde C. Snow, Warren M. Causey, Peter Hanson, Jerry Fineg et al Dec. 1968 10 p refs

(FAA-AM-68-24) Avail: CFSTI

It is established that the lap (seat) belt offers considerable protection against injury or death in crash environments; but there has been controversy over the injury potential to the pregnant female. This question is of importance in consideration of restraint and seat protective environments for both aircraft and automotive vehicles. This study is concerned with the clinical, experimental, and applied aspects of the problem. Tests utilizing pregnant baboons were run on the Daisy Decelerator, and clinical case histories were obtained in automotive accidents involving late-term pregnant women through cooperation of the California and Oklahoma Highway Patrol and individual obstetricians. Medical evidence for concern is outlined, and the experimental findings to date are noted. Author

N69-29943*# General Technical Services, Inc., Upper Darby, Pa.

DEVELOPMENT OF A SPECTRAL ANALYZER Progress Report, 8 Mar.–7 Jun. 1968

A. S. Iberall 26 Jun. 1968 4 p

(Contract NASw-1819)

(NASA-CR-101670; PR-3) Avail: CFSTI CSCL 06C

Research continued on the glucose level in mammalian blood by analysis of 15 second samples obtained from 10 rats. The results were found to be in agreement with those of previous studies on guinea pigs, mice, and humans. Also of importance was a comparison analysis of two subjects, one with polycythemia. The results, while inconclusive, did show very large oscillations in the polycythemic subject. Another area of experimentation involved a study of the effects of hyperoxia on the flow of red cells in capillaries in the panniculus muscle of the mouse. Two subjects were taken up to 4 atmospheres of pure oxygen in increments of 1 atmosphere for periods at one hour at each stage and one half hour at the highest pressure. Results indicated no serious changes in the microvasculature. D.L.G.

N69-29954# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE APPLICATION OF AVIATION IN AGRICULTURE AND FORESTRY, PART 1

M. B. Azaryan et al 23 Aug. 1968 268 p refs Transl. into ENGLISH of the book "Primeneniie Aviatsii v Sel'skom i Lesnom" Moscow, Izd-vo Transport, 1966 p 1-381

(AD-685458; FTD-MT-24-101-68-Pt-1) Avail: CFSTI CSCL 1/1

The work gives an account of aerial agricultural operations in the USSR and the latest achievements of science and advanced experimentation in the field. It describes the agricultural apparatus of aircraft and helicopters; the chemicals used in aerial and chemical operations and the methods of their application; the periods in which the aerial treatments are conducted in the various

agricultural crops; the aerial-chemical methods of controlling weeds, pests and diseases of agricultural crops and forests and also infection carriers; and the organization of aerial-chemical operations in the application of aviation to agriculture and forestry.
Author (TAB)

N69-29855# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE APPLICATION OF AVIATION IN AGRICULTURE AND FORESTRY, PART 2
M. B. Azaryan et al 23 Aug. 1968 206 p refs Transl. into ENGLISH of the book "Primenenie Aviatsii v Selskom i Lesnom" Moscow, Izd-vo Transport, 1966 p 1–381
(AD-685419; FTD-MT-24-101-68-Pt-2) Avail: CFSTI CSCL 2/1

The work gives an account of aerial agricultural operations in the USSR and the latest achievements of science and advanced experimentation in the field. It describes the agricultural apparatus of aircraft and helicopters; the chemicals used in aerial- and chemical operations and the methods of their application; the periods in which the aerial treatments are conducted in the various agricultural crops; the aerial-chemical methods of controlling weeds, pests and diseases of agricultural crops and forests and also infection carriers; and the organization of aerial-chemical operations in the application of aviation to agriculture and forestry.
Author (TAB)

N69-29888# Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires.
EFFECT OF NON-LETHAL WHOLE-BODY GAMMA IRRADIATION ON THE SPONTANEOUS AND EVOKED ELECTROENCEPHALOGRAPHIC ACTIVITIES OF THE ADULT RABBIT [EFFETS D'UNE IRRADIATION GAMMA GLOBALE NON LETALE SUR LES ACTIVITES ELECTROENCEPHALOGRAPHIQUES SPONTANEES ET EVOQUEES DU LAPIN ADULTE]
Louis Court Feb. 1969 206 p refs In FRENCH; ENGLISH summary
(CEA-R-3693) Avail: CFSTI

All the experimental methods described (animal preparation, precise physiological techniques, dosimetry, biological information processing) allowed one to follow the changes during 15 days in the spontaneous and evoked electroencephalographic activities of rabbits submitted to non-lethal 400 rads whole-body γ-irradiation. Behavioral troubles, changes in the arousal state and in the spontaneous electrical activity of the neo-cortex and hippocampus were noted continuously together with enhanced cortical excitability, and the appearance of elements of the paroxystic series sometimes contrasting with a general decrease in amplitude. After a visual stimulus the general morphology of evoked activities at the level of the primary visual areas and hippocampus was unchanged, but enhanced latencies and delays and less systematic modifications in amplitudes seemed to show a direct effect of radiation on the nervous system and sensorial activities ; these troubles seemed to arise independently from the basic electrical activity. The changes observed were usually transitory and varied with each individual. A hypothesis is presented to explain the arousal troubles and the general evolution of spontaneous electrical activity in the brain.
Author (ESRO)

N69-30085*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
A MATHEMATICAL MODEL OF THE EFFECT OF A PREDATOR ON SPECIES DIVERSITY
J. N. Yang and C. R. Weston 15 Jun. 1969 24 p refs
(Contract NAS7-100)
(NASA-CR-101669; JPL-TR-32-1359) Avail: CFSTI CSCL 06C

The presence of two species in the same environment with a common limiting resource is paradoxical if competition for the limiting resource is the only consideration: one or the other of the species must be eliminated. This analysis shows that a normally unsuccessful competitor for the limiting resource may persist when there is a predator on the otherwise successful species. The modified assumption and different parametric values which are considered do not alter this generalization. The working model is of bacteria growing in a chemostat; however, there is no reason to assume the resultant conclusions are restricted to a bacterial system, an experimental situation, or terrestrial organisms. Author

N69-30091# Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires.
EFFECTS OF DIETHYLENE TRIAMINE PENTA-ACETIC ACID AEROSOL ON LUNG CONTAMINATION BY LANTHANUM [INFLUENCE DU DTPA EN AEROSOL SUR LES CONTAMINATIONS PULMONAIRES AU LANTHANE]
Christian Pasquier, Dominique Voisin, Pierre Thieblemont, Gérard Perrault, and Jean-Pierre Bayard Apr. 1969 21 p refs In FRENCH; ENGLISH summary
(CEA-R-3735) Avail: CFSTI

Applying DTPA aerosol for the treatment of lung contamination by lanthanum gave data on its effectiveness as a function of time. Provided it was administered early during the two hours after exposure, over 50 per cent could be removed using lower therapeutic doses than those prescribed for other routes of administration. Its association with various enzymes did not enhance the chelator therapeutic effect. The constant of passage of lanthanum through the alveolar wall was calculated to be 0.016 mn^{-1}. A large part cannot be mobilized by DTPA and the physicochemical mechanisms involved in this protection are now being investigated.
Author (ESRO)

N69-30114*# Chicago Univ., Ill. Dept. of Biophysics.
INTEGRATED RESEARCH AND TRAINING PROGRAM IN MOLECULAR BIOLOGY: ULTRASTRUCTURE AND ELECTRON MICROSCOPY Annual Progress Report
Humberto Fernandez-Moran [1968] 69 p refs
(Grant NsG-441-63; Contract AT(30-1)-2278; Grants NIH B-2460; NIH NB-04267)
(NASA-CR-101583) Avail: CFSTI CSCL 06C

A progress summary is presented on an integrated research and training program in molecular biology. The major effort during the past year was devoted to the organization and initial operation of the special electron microscope laboratories for the proposed program. Specific research was carried out in the following areas: continuation of correlated electron microscope and biochemical studies of mitochondrial membranes which resulted in the detection and isolation of a fundamental unit of energy transduction and studies of pyruvate dehydrogenase complex of *Escherichia coli*; electron microscope and electron diffraction studies of DNA macromolecules in solution; collateral development work on improvement of preparation techniques and instrumentation for high resolution electron microscopy; correlated electron microscope and electron diffraction studies of Orgueil carbonaceous chondrite and pre-Cambrian organized systems; and development of techniques for electron optical examination of extraterrestrial matter. B.P.

N69-30210# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOME PROBLEMS IN PREVENTING MOTION INTERFERENCES DURING PROLONGED EKG INVESTIGATIONS
E. D. Dubrovin Jul. 1968 15 p refs Transl. into ENGLISH from the book "Radioelektronnye Pribory Dlya Biologicheskikh i Meditsinskikh Issledovanii" Moscow, Izd-Vo Nauka, 1966 p 18–29
(AD-685144; FTD-HT-23-336-68) Avail: CFSTI CSCL 6/5

Experiments were performed to investigate the possibilities of using the synchronous cumulation method for isolating EKG

recordings from interferences caused by movements of the subject. A specialized medical data-processing computer, the ATAS-401 (Nihon Konden Kogyo Co., Ltd., Tokyo, Japan) which accomplishes synchronous cumulation was used in the experiments. A schematic diagram showing the connection of the devices used is shown. Use of the synchronous cumulation method greatly improved the structure of EKG curves recorded during various movements of the subject. Results of three cumulated EKG recordings indicated that interferences produced by movements are rarely characterized as a stationary random process. In a majority of cases, the character depends on the time factor. Selection of the number of cumulation cycles is discussed. Successful use of the synchronous cumulation method depends on the periodicity of the cumulated signal. Problems in recording signal changes and a method of automatic regulation are discussed. The synchronous cumulation method with automatic regulation of cumulation time depending on the interference level is now being clinically tested in a new variant of the device for recording oxygen starvation of the human cardiac muscle. Author (TAB)

N69-30226# Pittsburgh Univ., Pa. Dept. of Pharmacology.
DESIGN AND EVALUATION OF EXPERIMENTS WITH LABYRINTHINE STATORECEPTORS
Gerhard Wernek, Hershel Sacks, and James Fierst Mar. 1969 18 p refs
(Grant AFOSR-1005-66)
(AD-685171; TR-2; AF-AFOSR-69-0852TR) Avail: CFSTI CSCL 6/12

The report establishes a theoretical framework and computational procedures which lead to an experimental strategy for distinguishing between two alternative modes of operation of the vestibular statoreceptors: the question is whether individual kinocilia in the maculae sacculi and utriculi are innervated by single vestibular afferent fibers, or else, whether convergence of neural discharges originating from several kinocilia with different orientation of functional polarization occurs in vestibular afferent fibers. If the former condition prevails, it is possible to calculate the vector of maximal sensitivity of each kinocilium from the polar plot of nerve discharge rates, obtained at suitable head positions in the gravity field. The principle of the procedure consists in the matching of experimental data with a computer simulated model of sacculus and utriculus. Author (TAB)

N69-30255# Tulane Univ., New Orleans, La. La Delta Regional Primate Research Center.
A STUDY OF THE FEASIBILITY OF STIMULATING NEURONS BY ELECTROMAGNETIC WAVES
Ernest E. Erickson (La. State Univ.) and Ralph A. Kinney (La. State Univ.) Mar. 1969 35 p refs Final Rept. made at Stanford Res. Inst.
(Contracts Nonr-475(11); N00014-68-C-0184)
(AD-685044; TR-2) Avail: CFSTI CSCL 6/16

This study was to determine the feasibility of using externally applied electromagnetic fields to selectively stimulate electrically any desired point deep in the brain of primates using external electrodes. The squirrel monkey was chosen as the animal specimen for all calculations. Values of the dielectric constants and conductivity of biological tissue and the consequent electromagnetic properties were applied to three potential methods described in detail, including a pulsing technique, a focusing lens system, and a method of creating standing waves in the brain. For all three methods, it was found to be impossible to electrically stimulate neurons within the brain using microwave frequencies. This is because relatively high frequencies are necessary to obtain accuracy, but attenuation of the electrical field increases exponentially with frequency, thereby limiting depth of penetration. One possible solution is to search for an attenuation window in brain substance, much as exists for sea water at visible light frequencies. Author (TAB)

N69-30274# Aztec School of Languages, Inc., Maynard, Mass.
SWEAT LOSS AND BEVERAGE INTAKE OF MINERS AND LABORERS EMPLOYED IN A HIGH TEMPERATURE ENVIRONMENT [SCHWEISSVERLUST UND GETRAENKEAUFNAHME BEI BERGLEUTEN UND HITZEARBEITERN]
Gunther Lehmann et al Washington NASA Jun. 1969 25 p refs Transl. into ENGLISH from Arbeitsphysiol. (West Ger.) v. 11, 1941 p 73–100
(Contract NASw-1692)
(NASA-TT-F-12313) Avail: CFSTI CSCL 06P

Studies were carried out on 21 miners and 10 laborers of various plants to obtain high temperature environment data on the magnitude of sweat loss during the working shift, on chlorine loss, on water intake and chlorine supply. Beside an absolute water and chlorine balance, an osmotic balance was calculated from the results, which indicates to what extent the subjects have drunk too much or too little for the maintenance of the osmotic pressure of their tissue fluid. It was determined that the miners drink, for the most part, too little and leave their place of employment with a strong fluid deficit. Author

N69-30354# Gesellschaft fuer Strahlenforschung m.b.H., Munich (West Germany). Institut fuer Biologie.
PATHOGENESIS OF GENETIC AND SOMATIC RADIATION DAMAGE [PATHOGENESE GENETISCHER UND SOMATISCHER STRAHLENSCHAEDEN] Annual Report, 1968
May 1969 23 p refs In GERMAN; ENGLISH summary
(Contract EURATOM-045-65-1-BIAD)
(EUR-4097.d) Avail: CFSTI

The frequency and mode of origin of genetic damage and delayed somatic damage induced in animals by ionizing radiation are discussed. In research on mammals (mice) and fish, mutations at specific loci and lethal mutations were studied, likewise the effects of radiation on polygenic factors and the extent to which these are dependent on dose and dose-rate. In the course of electrophysiological research on the central nervous system in normal and irradiated cats, the reaction potentials of various cortical regions were analyzed and measurements concerning the electrical excitability of the neocortex were effected. The work is centered on investigations of radium-224 (thorium X) and comparison with the longlived radium-226, with particular reference to the formation of bone tumors. A study was begun on delayed damage after the incorporation of radium-224 in mice. Histopathological and histochemical studies were conducted on bones following internal and external irradiation, together with studies on the behavior of the alkaline phosphatase in the mucous membrane of the small intestine in mice after X-irradiation, and on the influence of a whole-body irradiation on the spleen enzyme pattern in various species of animals. Author

05 BIOTECHNOLOGY

Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also 04 Biosciences.

N69-29073 Vanderbilt Univ., Nashville, Tenn.
THE HUMAN CONTROLLER WITH PREVIEWED INPUTS
Leonard Estes Joseph Meginn(Ph. D. Thesis) 1968 83 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 69-17983

The results are reported of experiments conducted with human controllers when the subject could see the input in the future. For this case, the controller can prepare, in advance, for a response, and it is likely that his characteristics may be describable in terms of an optimal control system. The experiments were designed to test certain aspects of such a description. The experiments are described, and the results are tabulated and/or graphed. One series of experiments was conducted to determine the ability of the controller to predict accurately the proper time to make a response. It was concluded that the human controller tends to respond very near the proper time but not too accurately. For these experiments the controller required approximately one-half second to make this prediction. A second series of experiments was conducted to determine the ability of the controller to change his performance as required by different scoring criteria. Dissert. Abstr.

N69-29174# Ohio State Univ., Columbus. Human Performance Center.

SOME PRINCIPLES FOR DESIGN OF DECISION SYSTEMS: A REVIEW OF THE FINAL PHASE OF RESEARCH ON A COMMAND-CONTROL SYSTEM SIMULATION Final Report, 1 Sep. 1966–31 Mar. 1968

William C. Howell and Charles F. Gettys. Wright-Patterson AFB, Ohio AMRL Nov. 1968 54 p refs

(Contract AF 33(615)-2248)

(AD-684548; AMRL-TR-68-158) Avail: CFSTI CSCL 5/5

The chief objective of the present research was to anticipate a number of issues which would arise if an automated aid to decision making were actually implemented. Questions asked included: (1) What happens to system performance if probabilistic information is reduced to an all-or-none form at some point in processing. (2) Can a hierarchical (specialist-nonspecialist) system use limited resources effectively to gather predictive data. (3) Can a system in which aggregation of predictive information is automated benefit from a manual supplement (to handle unanticipated data). Results summarized in the nine principles suggest that (1) all-none transformation of probabilistic data can seriously degrade system performance, especially if system response is in any way dependent upon likelihood of alternative states (but there are several important exceptions to this rule); (2) potential deficiencies in allocation of resources by the system should be guarded against in future system designs; (3) an automated aggregation design can be enhanced by a manual supplement to deal with unanticipated data; (4) a voice communication capability does not offset system performance deficit attributable to degradation of other processing modes; and (5) the value of experience in certain aspects of human decision performance may not extend far beyond the specific conditions under which the experience was acquired. Author (TAB)

N69-29644*# Baylor Univ., Houston, Tex. Coll. of Medicine.

EVALUATION OF MATERIALS PROPOSED FOR USE IN SPACE FLIGHT Final Report

W. Christopher Duncan and John M. Knox [1967] 3 p refs

(Contract NAS9-8109)

(NASA-CR-101731) Avail: CFSTI CSCL 05/E

The primary irritancy and allergenicity of a flame proof paper proposed for use in space flight were evaluated in skin tests on animals and human volunteers. Guinea pigs were used in the animal tests. The test method is briefly described. The paper was found to be free of irritant and allergic potentials. K.W.

N69-29648# Virginia Univ., Charlottesville. School of Engineering and Applied Sciences.

LEARNING CONTROL SYSTEMS AND PATTERN RECOGNITION Semiannual Progress Report, 15 Mar.–15 Sep. 1968

J. W. Moore, E. S. McVey, B. J. Gilpin, P. F. Chen, E. J. White et al Feb. 1969 307 p refs

(Contract DAAB07-68-C-0066)

(AD-684325; ECOM-0066-2; SAPR-2) Avail: CFSTI CSCL 6/4

Topics covered include finite state sequential machines, thin film deposition research, construction of chip matrix receptors, neural networks of the retina, phototransistor response testing, position and velocity detection systems, and character recognition. A feasibility study of the theory and design of position and velocity detecting systems using pattern recognition concepts is presented. Design parameters of the systems receptor are considered. The results indicate that the required size of the receptor matrix is relatively large for available solid state receptors. Methods of receptor resolution improvement through input signal perturbation are presented. The results indicate that an order of magnitude improvement in position detection accuracy can be obtained by appropriately choosing the objects size, sensor element geometry, and the amplitude of the perturbation signal. A character recognition machine that is insensitive to translation and, to a lesser degree, dilations and angular orientation of the input samples is described. The system consists of three stages: (1) a receptor to make certain measurements on the input patterns to be classified; (2) a preprocessor to subdivide the pattern set into sixteen subsets; and (3) a categorizer to separate the members of the individual subsets. Author (TAB)

N69-29720# Naval Research Lab., Washington, D.C.

EXPERIMENTS IN DISCRIMINATION AND CLASSIFICATION

J. J. Freeman Dec. 1968 17 p refs

(AD-684065; NRL-6742) Avail: CFSTI CSCL 5/10

In discrimination problems, one usually must consider many variates simultaneously. A nonparametric discrimination method, based on estimating the probability densities of two populations is now available and appears generally applicable to discrimination problems, based on the results of extensive experiments. The nonparametric method may also be combined with Gambas learning without teacher or classification procedure to obtain a new classification technique which considers all variates simultaneously. Author (TAB)

N69-29747# Joint Publications Research Service, Washington, D.C.

TRANSLATIONS ON EASTERN EUROPE SCIENTIFIC AFFAIRS, NO. 58, ON THE BIOMECHANISM OF INFORMATION PROCESSING

Pal Greguss 9 Jun. 1969 48 p refs Transl. into ENGLISH from Magy. Fiz. Folyoirat (Budapest), no. 6, Apr. 1968 p 526–538

(JPRS-48186) Avail: CFSTI

The mechanism of biological information processing is interpreted on the basis of the hologram principle. Statements are substantiated partly by evaluating experimental data derived from echo location of bats, and partly on the basis of model experiments. It is proposed that the biological hologram principle may be generalized and with it higher order brain processes might be interpreted. Apparatus, experimental procedure, and computations are detailed, and future lines of investigation suggested. K. R.G.

N69-29786# Grumman Aircraft Engineering Corp., Bethpage, N.Y. Research Dept.

AIR POLLUTION CONTROL: A CRITICAL OVERVIEW

A. Hershaft Jun 1969 33 p refs
(RM-446) Avail: Issuing Activity

A concise critical introduction is presented on the general status and most pressing technical problem areas of air pollution control. Following a discussion of the nature, effects, and measurement of air pollutants, discharge and control problems are examined within the context of each of the three major sources of air pollution. Subsequent portions deal with control legislation and programs, and the concluding section outlines the most pressing technical problems in each of the areas mentioned. Author

N69-29694# Embry-Riddle Aeronautical Inst., Daytona Beach, Fla.
ANGLE OF ATTACK PRESENTATION IN PILOT TRAINING Final Report
Frank G. Forrest Mar. 1969 77 p refs
(Contract FA-67-W-1811)
(FAA-DS-69-6) Avail: Issuing Activity

The possible value of angle of attack presentation in addition to other required instruments for flight training in general aviation aircraft was determined. Two groups of inexperienced flight students from the same population as measured by a mental aptitude test (CTMM) participated in identical flight training programs at the private pilot level. However, the experimental group completed the course using an angle of attack indicator. Statistical comparison of performance measurement scores revealed no significant difference in ability between the two groups. It was concluded that the angle of attack indicator in addition to airspeed was unimportant during private pilot flight training. Author

N69-30166# Federal Aviation Administration, Washington, D.C. Dept. of Transportation.
MEDICAL FACTORS IN U.S. GENERAL AVIATION ACCIDENTS
P. V. Siegel and S. R. Mohler Jan. 1969 8 p refs
(AM-69-2) Avail: Issuing Activity

About 90 percent of fatal U. S. general aviation accidents involve factors other than the aircraft or outside circumstances. This necessarily brings the flight surgeon into the mainstream of aviation safety activities. This paper describes some relatively recent accidents which illustrate the roles played by medical factors. Preventive programs are discussed which have a direct focus on the medical factors which will potentially contribute to future accidents. Author

N69-30188*# Harvard Univ., Boston, Mass. School of Public Health.
PREDICTING HUMAN PERFORMANCE IN SPACE ENVIRONMENTS
Warren H. Teichner and Diane Olson Washington NASA Jun. 1969 186 p refs
(Grant NGR-22-007-070)
(NASA-CR-1370) Avail: CFSTI CSCL 06L

An attempt is made to provide a systematic framework which can be used for predicting the effects of the physical environment on human performance. The nature of the approach was: (1) to develop a general classification scheme for the description of tasks; (2) to develop postulates from the basic literature of psychology so as to formulate a quantitative model of wide scope representing fundamental behavioral processes assumed to underlie performance at the tasks; (3) to develop relationships between environmental conditions and major physiological effects known or thought to result from them; (4) to postulate relationships between selected ones of the underlying behavioral processes and the physiological effects, and then to use these relationships along with the performance model to predict the effects of the environment on performance; and (5) to develop a general criterion for determining the environmental conditions which should be considered limiting. Author

N69-30217# Iowa Univ., Iowa City. Dept. of Mathematics.
MEMORY REQUIREMENTS OF TWO-WAY VERSUS ONE-WAY AUTOMATA
Bruce H. Barnes Feb. 1969 8 p refs
(Contract N00014-68-A-0500)
(AD-684941; THEMIS-UI-TR-5) Avail: CFSTI CSCL 9/4

The article presents an example of a two-way automaton which has significantly fewer states than any one-way automaton accepting the same set of tapes. Thus, memory space can be saved by using a two-way automaton. The savings in space, however, is accompanied by an increase in recognition time. Author (TAB)

N69-30350# Board of Trade, London (England).
THE SAFETY PERFORMANCE OF UNITED KINGDOM AIRLINE OPERATORS: SPECIAL REVIEW
1968 113 p
Avail: HMSO 8s 6d

The results of an aircraft accident investigation are presented. The responsibilities of the Aviation Safety Division and the Air Registration Board are outlined, and the history and procedures of the air operator's certificate are reviewed. An analysis of accidents from 1955 to 1967 shows that pilot's incompetence and poor judgment, and aircraft airworthiness deficiencies were the factors contributing most to the accidents. A statistical study indicates that the safety levels of public transport operators have improved, the safety levels of independent operators were significantly lower than that of corporations, and the safety levels of the United Kingdom airlines are equal to those achieved by French and ICAO airlines but are probably lower than those of United States and Australian airlines. The effects of aircraft age on safety were also examined, and it is felt that age is a minor influence, however, newer craft are designed to a higher standard. Recommendations are made for improving the training, testing, and licensing of air and ground crews and maintaining and checking the aircraft. N.E.N.

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N69-29001 Illinois Univ., Urbana.
INFRARED AND OTHER SPECTRAL STUDIES ON BIS-(O-PHENYLENE-BISDIMETHYLARSINE)- COBALT (III) COMPLEXES
Bobbye Kaye Whitenton Baylis (Ph.D. Thesis) 1968 251 p
Avail: Univ. Microfilms: HC $11.50/Microfilm $3.25 Order No. 69-1295

A number of complexes of the type $[Co\ diars_2X_2]^+$, where X represents a monodentate species and X_2 represents a bidentate species, were prepared and studied in order to determine the extent of softening caused by the bidentate ligand o-phenylene-bisdimethylarsine (denoted diars) on a hard acid. In this study a second diacetato isomer and dinitrato, carbonato and oxalato complexes were prepared. All of these complexes proved to

be quite similar to their bis-ethylenediamine Co(III) analogues. The differences in behavior which were observed, i.e., slower reactions and tendency to polymerization, could be attributed to the lack of any acidic hydrogens in the complex and to the use of non-aqueous solvents. Dissert. Abstr.

N69-29002 North Carolina Univ., Chapel Hill.
THE ELECTRONIC STRUCTURE OF COPPER(II) CHLORIDE PYRIDINE N-OXIDE
William Evans Parker (Ph.D. Thesis) 1968 52 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-1654

The one-electron molecular orbital method which includes the Wolfsberg–Helmholz approximation has been used to calculate the energy levels for $CuCl_2$-$2C_5H_5NO$ and for $[(C_5H_5NO)CuCl_2]$. Reasonable values for the parameters involved in these calculations were determined by fitting the bands in the spectrum of the monomer to an energy level diagram. The same set of parameters were then used in the treatment of the binuclear complex in an attempt to explain the interaction that takes place between the unpaired electrons on the two adjacent copper atoms. Taking the geometry of the dimeric complex into consideration, the Wolfsberg–Helmholz approximation and the one-electron molecular orbital method predicts the electron–electron interaction to be one of super-exchange through the sigma orbitals of the bridging oxygen atoms. Dissert. Abstr.

N69-29006 Washington Univ., St. Louis, Mo.
VAPORIZATION CHARACTERISTICS OF ZINC CHLORIDE, ZINC BROMIDE, AND ZINC IODIDE AND SOME THERMODYNAMIC PROPERTIES OF THE ZINC CHLORIDE–SODIUM CHLORIDE SYSTEM
Donald Winston Rice (Ph.D. Thesis) 1968 148 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 69-1208

The vapor pressures, condensation coefficients, and approximate vapor compositions over solid zinc chloride, zinc bromide, and zinc iodide were determined by a combination of torsion effusion, Knudsen effusion, and mass spectrometric techniques. Thermodynamic properties have been calculated and compared with the results of other investigators. Discrepancies between the gas entropies calculated by two methods have been discussed. The measured vapor pressures were appreciably higher than those reported by Niwa, but were in good agreement with an extrapolation of reported values above the liquids. All three solid halides exhibited condensation coefficients close to unity over the temperature interval studied (190°–340°). No anomalous behavior in the condensation coefficient was observed for zinc chloride at its melting point. The results indicate that the vapors are primarily monomeric zinc halides. Dissert. Abstr.

N69-29009 Northwestern Univ., Evanston, Ill.
THE SYNTHESIS OF OLIGOTHYMIDYLATE DERIVATIVES ON INSOLUBLE POLYMER SUPPORTS
Marvin Harry Caruthers (Ph.D. Thesis) 1968 237 p
Avail: Univ. Microfilms: HC $10.80/Microfilm $3.10 Order No. 69-1811

Procedures are described for chemically synthesizing polynucleotides in a stepwise and predetermined manner on insoluble polymer supports. These studies were initiated in an attempt to simplify the laborious and time consuming isolation procedures inherent in any repetitive polynucleotide synthesis. A growing polynucleotide chain attached to the support was separated from reagents simply by filtration. Therefore no intermediate purification steps were necessary. As a result of experiments examing different approaches to polynucleotide synthesis, a method utilizing intermediate oligonucleotide triesters was found to be the most satisfactory. High yields were obtained at each step and degradation of freshly synthesized oligonucleotide polymer was not observed. The insoluble matrix was a popcorn polymer prepared from styrene, p-divinylbenzene, and p-vinylbenzoic acid. Dissert. Abstr.

N69-29010 Stanford Univ., Calif.
A CONFIGURATION INTERACTION STUDY OF THE ISOELECTRONIC SERIES METHANE THROUGH NEON
William John McInerny (Ph.D. Thesis) 1968 97 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 69-256

It has been shown that valence bond CI calculations which utilize direct integrations over LCAO's for electron repulsion integrals are feasible and can be performed economically. This technique was applied to the central hydrides of carbon through fluorine and their isoelectronic atom neon. The calculations utilized the SCF wave function as the first configuration. Additonal configurations were obtained by promotion of electrons from SCF occupied orbitals to other MO's of appropriate symmetries. Practical considerations limited the numerical accuracy and the extent of the CI's used in this work, and consequently only a fraction of the valence-shell correlation energy was obtained. However, the advent of more powerful computation equipment, and the implementation of analytical techniques developed concurrently with the present work, make it reasonable to carry out larger calculations and to increase the numerical accuracy. Dissert. Abstr.

N69-29017 Maryland Univ., College Park.
KINETICS OF THE REACTIONS BETWEEN TRIS(1,10-PHENANTHROLINE)IRON(II) ION AND THE CHLORINE-OXIDANTS IN AQUEOUS SOLUTION
Bassam Zekin Shakhashiri (Ph.D. Thesis) 1968 84 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 69-722

The reactions between tris(1,10-phenanthroline)iron(II) and chlorate ion, chlorine dioxide, chlorite ion, hypochlorous acid, and chlorine in aqueous solution were studied. The progress of each reaction was determined spectrophotometrically by measuring the change in absorbance due to $Fe(phen)_3^{2+}$ at 5100Å. The $Fe(phen)_3^{2+}$–HClO reaction is slow initially, but becomes more rapid. This autocatalytic behavior is explained in terms of formation of Cl_2 which reacts faster than HClO with $Fe(phen)_3^{2+}$. No detectable reaction was found between $Fe(phen)_3^{2+}$ and chlorate ion at 35°. The $Fe(phen)_3^{2+}$–Cl_2 and $Fe(phen)_3^{2+}$–ClO_2 reactions involve one-electron steps and are postulated to proceed primarily via an outer-sphere path since $Fe(phen)_3^{3+}$ was found to be a major product. Dissert Abstr.

N69-29018 Northwestern Univ., Evanston, Ill.
LEWIS BASICITY OF SQUARE PLANAR d^8 METAL COMPLEXES
Robert Neal Scott (Ph.D. Thesis) 1968 185 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 69-1939

The basicity of square planar d^8 metal complexes toward group III Lewis acids was investigated. Stoichiometries and the extent of interaction in these systems were determined by one or more of the following techniques: tensimatric titrations, cryoscopic titrations, spectrophotometric (ultraviolet and visible) titrations, and infrared titrations. Monomeric 1:1 adducts were formed in solution between BF_3 and iridium(I) complexes of the type $IrCOCl(L)_2$. In the case of the triphenylphosphine and tris(p-biphenyl)phosphine complexes 1:2 adducts could be prepared also. The adduct of the former appears to be monomeric in benzene. A stable 1:1 adduct

was prepared between $B(C_6F_5)_3$ and $IrCOCl(PEt_2Ph)_2$. The ^{19}F NMR spectrum of this monomeric complex was consistent with the presence of a four coordinate BX_3 group. Dissert. Abstr.

N69-29019 Northwestern Univ., Evanston, Ill.
FIVE-COORDINATION IN 3d AND 5d TRANSITION METAL COMPLEXES
Kenneth Norman Raymond (Ph.D. Thesis) 1968 166 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 69-1916

The $[Ni(CN)_5]^{3-}$ ion was isolated from aqueous cyanide solution in the stable salts. The $[Ni(CN)_5]^{3-}$ ion is diamagnetic and deep red in these solids, as in aqueous solution. A complete X-ray crystal structure analysis of the $[Cr(en)_3]^{3+}$ salt was completed. There are two, independent, five-coordinated $[Ni(CN)_5]^{3-}$ ions in the compound; one is a perfect square pyramid, and the other is a distorted trigonal bipyramid. The average angle between opposite basal carbon atoms is 159.5(4)°. The distorted trigonal bipyramid has an average axial bond length of 1.838(9)Å. The angle between the axial carbon atoms is 172.8(5)°. There are two equivalent equatorial bonds of average length 1.907(9)Å and one longer equatorial length of 1.992(14)Å. This longer bond and the large angle, 141.2(5)°, between the other two equatorial carbon atoms are the primary distortions from a regular trigonal bipyramid. Dissert. Abstr.

N69-29031 Pennsylvania Univ., Philadelphia.
EXCHANGE REACTION KINETICS OF ALKYL IODIDES OVER METAL CATALYSTS
Roger Allan Morrison (Ph.D. Thesis) 1968 108 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-145

The exchange of iodine between ethyl and propyl iodides has been studied over copper, iron, nickel, palladium, platinum, rhodium, and iridium catalysts in a flow reactor at temperatures less than 210°C. Further the exchange of iodine was studied between various alkyl groups over the same catalyst. Here iodine was exchanged between ethyl and methyl, ethyl and butyl, and ethyl and isopropyl iodides over a rhodium catalyst. It was found that decomposition occurred over metals whose iodides have high heats of formation, such as nickel and iron. This resulted in surface metal iodide formation and catalyst poisoning. In the series in which the ethyl and propyl iodides were studied over various metals it was found that the energies of activation were constant within one kcal/mole of the experimentally found values of 12 kcal/mole. This was attributed to the chemical similarity of the catalysts used, most being in the noble metal family. Dissert. Abstr.

N69-29032 Oregon Univ., Portland.
KINETICS OF THE THERMAL EXCHANGE OF IODINE WITH SUBSTITUTED IODOBENZENES
Chup Yew Mok (Ph.D. Thesis) 1968 142 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-37

The isotope exchange reaction of iodine with iodobenzene, p-iodoanisole and p-iodonitrobenzene in the solvents hexachlorobutadiene-1,3 and nitrobenzene has been studied in the temperature range 147° to 190°C. Conventional techniques for isotope exchange experiments were employed. Iodine-131 was used as the tracer. The radioactive iodine was initially incorporated only in the element, and the reaction was followed by measuring the fraction of radioactivity that became organically bound. The reaction is first order in the organic iodide and half order in iodine. It is accelerated by the p-methoxy group, but only slightly retarded by the p-nitro group. In nitrobenzene, the reaction was complicated by the presence of heterogeneous effects. Although attempts were made to eliminate such effects, it is not entirely clear that the final results can be attributed solely to a homogeneous process. Dissert. Abstr.

N69-29037 Akron Univ., Ohio.
MECHANISTIC STUDIES IN ORGANOPHOSPHORUS CHEMISTRY
Natvarlal Khandubhai Patel (Ph.D. Thesis) 1968 116 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 68-17864

The reactions of a series of phosphinothioic halides with Grignard reagents were investigated. Reactions of dimethyl-, diethyl-, or di(*n*-propyl)phosphinothioic halides with Grignard reagents gave trisubstituted phosphine sulfides in high yield. Methyl phenyl phosphinothioic chloride reacted with aliphatic or aromatic Grignard reagents to yield both trisubstituted phosphine sulfides and *meso*-1,2-dimethyl-1,2-diphenyl diphosphine disulfide. Diphenyl phosphinothioic chloride reacted with aliphatic Grignard reagents to yield tetraphenyl diphosphine disulfide, but it reacted with aromatic Grignard reagents to yield trisubstituted phosphine sulfides. These results indicate that metal–halogen exchange processes precede the P–P coupling step involved in diphosphine disulfide formation. The high stereoselectivity of the coupling step was explained. Dissert. Abstr.

N69-29042# Sandia Corp., Albuquerque, N.Mex.
REACTION RATES FOR HIGH-TEMPERATURE AIR WITH CARBON AND SODIUM IMPURITIES
Mina L. Camicom May 1968 150 p refs Sponsored by AEC (PB-182622; SC-R-68-1799) Avail: CFSTI CSCL 07D

The values used by a number of investigators for the rate constants of high-temperature (1000K) homogeneous gaseous reactions involving species of the elements nitrogen, oxygen, carbon and sodium were compiled and are presented in tabular form. Included are reactions involving neutral species, charged species, free electrons, some species in excited electronic or vibrational states, and radiative processes. Author (USGRDR)

N69-29046 Nebraska Univ., Lincoln.
A SPECTROSCOPIC STUDY OF SOME COPPER (II) β-KETOAMINE CHELATES
David Elmer Erdmann (Ph.D. Thesis) 1968 78 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-18016

A total of 17 samples of the type $[R'COCHC(-NR)CH_3]_2Cu$ were synthesized by combining an ammoniacal solution of copper nitrate, an ethanol solution of the β-ketoamine, and a small amount of sodium hydroxide (1M). The infrared, electronic, and mass spectroscopic properties of these chelates were then investigated. Two prominent transfer transitions in the ultraviolet region were found: (1) in the region from 3000Å to 3550Å, assigned as a $\pi \rightarrow \pi^*$ transition; and (2) in the region 2800Å, assigned as a sigma$_L$—metal transition. The infrared results provided additional information about the bonding involved. The Cu-O and Cu-N stretching frequencies occur near 480 and 515 cm^{-1}, respectively. The mass spectra of all of the compounds have a prominent parent ion peak, which indicates that the chelate is quite stable under mass spectrometer conditions. The stability of the chelates in the mass spectrometer follows a trend which appears to depend upon the steric and electronic properties of the R group. The stability of the chelate decreases as the steric hindrance and the electron-withdrawing power of the R group increases. Dissert. Abstr.

N69-29063 Delaware Univ., Newark.
THE PREPARATION AND PROPERTIES OF PHOSPHORUS CONTAINING POLYURETHANS
Richard Alan Dunbar (Ph.D. Thesis) 1967 144 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-1127

The phosphorus-containing polyurethans were prepared by interfacial and solution polymerization of 1,4-butanebis(chloro-

formate) and p-xylylene-α,α'-bis(chloroformate) with alkyldi-(m-aminophenyl)phosphine oxides, where the alkly group was methyl, n-butyl, and cyclohexyl. The polymers had number average molecular weights in the range of 5000 to 8000; those prepared by interfacial polymerization with p-xylylene-α,α'-bis(chloroformate) generally were of higher molecular weights than those from 1,4-butanebis(chloroformate). Tests w3re made of the stability to base and of the flame resistance of one of these polymers, poly[O-α,α-p-xylylene P-methyl-phosphorylbis(3-phenylcarbamate)]. The polymers proved to be as stable to alkaline hydrolysis as non-phosphorus ers proved to be as stable to alkaline hydrolysis as non-phosphorus analogs and also a film of the phosphorus polymer exhibited self-extinguishing properties when exposed to an open flame.

Dissert. Abstr.

N69-29054 California Univ., Davis.
TRANSITION METAL CATALYZED REACTIONS OF THE SILICON-HYDROGEN BOND
James Edward Lyons (Ph.D. Thesis) 1968 155 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 69-859

The stereochemistry of several types of reactions of the silicon–hydrogen bond in the presence of catalytic amounts of the group VIII metals were studied. The reactions are in most cases highly stereospecific and hence mechanistic pathways involving free silyl radicals or ions are clearly not involved. Reactions involving displacement of hydrogen from silicon by oxygen or nitrogen nucleophiles occur with inversion of configuration without exception. Reactions of the silicon–hydrogen bond with C-Cl, Si-D, or H_2 occur with retention. Rapid SiH–SiD exchange occurs in the presence of group VIII metal catalysts at room temperature. Such exchange occurs with complete retention of configuration at the optically active silicon center.

Dissert. Abstr.

N69-29059 Utah State Univ., Logan.
INFRARED CHEMILUMINESCENCE FROM REACTIONS OF THE OXIDES OF NITROGEN WITH ATOMIC SPECIES
Lorrie E. Mecham (Ph.D. Thesis) 1968 127 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 69-1080

The infrared emission in the region between 2 and 5 microns was observed for the processes which occur when active nitrogen reacts with nitrogen dioxide. The transfer of vibrational energy from N_2 to N_2O and the reaction of N with NO_2 were studied in a gas phase flow system. It was determined that the emission peaks between 2.2 and 2.4 μ and the peaks between 2.6 and 2.8 μ were due to vibrationally excited NO. The reaction of atomic nitrogen with nitrogen dioxide produces nitrous oxide as one of the products. The transfer of vibrational energy from N_2 to N_2O was shown experimentally. Using the intensity of the nitrous oxide emission at 4.5 μ as a tracer in measuring the concentration of vibrationally excited nitrogen, the decay of vibrational energy in nitrogen was studied as a function of nitrous oxide and nitrogen dioxide concentrations.

Dissert. Abstr.

N69-29060 Kansas Univ., Lawrence.
1,4 ADDITION OF AMINES TO O-BENZOQUINONES
Stanley Piekarski (Ph.D. Thesis) 1968 155 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-17437

A potentio-static technique was used to study the kinetics of the 1,4 additions of aromatic amines and amino acids to o-benzoquinones. The unstable o-benzoquinones were generated at a carbon paste electrode by the oxidation of the corresponding catechols. The overall reaction is classified as an ECE reaction (electron-transfer-chemical reaction-electron-transfer). The addition of aniline to 4-methyl-o-benzoquinone was studied as a function of pH. The displacement of chloride ion from 4,5-dichloro-o-benzoquinone by aniline was also studied as a function of H_0 in perchloric acid. The 1,4 addition of primary and secondary amino acids to 4-methyl-o-benzoquinone and o-benzoquinone was studied near pH 7. The free base of the amine group was found to be the attacking nucleophile. The mechanism of the 1,4 additions of these aliphatic and aromatic amines involves the attack of the unprotonated amine upon the o-quinone.

Dissert. Abstr.

N69-29063 Stanford Univ., Calif.
AN EQUILIBRIUM AND KINETICS STUDY OF THE CERIUM (IV)-ARSENIC (III) SYSTEM IN PERCHLORATE AND SULFATE MEDIA
Kenneth Gary Everett (Ph.D. Thesis) 1968 182 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 69-216

The cerium (IV)-arsenic(III) system in perchlorate and mixed perchlorate-sulfate media was made the subject of an extensive spectrophotometric equilibrium and kinetic study. The following concentration ranges were covered: 1×10^{-4} to 1×10^{-2} M Ce(IV); 1 to 6×10^{-3} M As(III); 1×10^{-3} to 1×10^{-2} M sodium sulfate; and 0.1 to 1.0 M perchloric acid, with ionic strength maintained at 1.0 M with sodium perchlorate. This experiment was necessarily made in conjunction with preliminary studies of (1) the hydrolysis of Ce(IV) in perchloric acid solution, and (2) the formation of Ce(IV)-sulfate complexes. The formation of two transient, red colored 1:1 Ce(IV)-As(III) complexes was noted in the experiment; and, as indicated in the other preliminary studies, these complexes differed in composition by one proton.

Dissert. Abstr.

N69-29072 Northwestern Univ., Evanston, Ill.
RATES AND MECHANISM OF FORMATION OF SOME NICKEL (II) COMPLEXES IN METHANOL AND SOME REACTIONS OF (METHYL-, METHOXY-)-CARBENECHROMIUMPENTACARBONYL
Paul Clifford Ellgen (Ph.D. Thesis) 1968 102 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 69-1824

The rates at which phenanthroline, bipyridine, thiocyanate ion, selenocyanate ion, dithiooxalate ion, and maleonitriledithiolate ion react with nickel (II) were determined in methanol solution. In addition, the rates at which the dithiooxalate ion and maleonitriledithiolate ion react with nickel (II) in aqueous solution were determined. A comparison of the rates in methanol solution to the rates in aqueous solution provides support for the interpretation of these reactions in terms of a mechanism involving interchange of ligand between inner and outer coordination spheres as the rate determining step. Interpretation of the experimental results in terms of other possible mechanisms is discussed and concluded to be less satisfactory. In addition, the reactions of (methyl-, methoxy-)carbenechromiumpentacarbonyl with benzotriazole, pyrazole, and 4H-1,3,4-triazole were examined. From the reaction with pyrazole, the compound pyrazolechromiumpentacarbonyl was isolated. The reaction with 4H-1,3,4-triazole yielded a compound of composition $C_9H_5CrN_3O_5$. Characterization data is given, but the information available is not adequate to permit assignment of the structure. Indications were observed that benzotriazole and pyrazole form unstable adducts with (methyl-, methoxy-)carbenechromiumpentacarbonyl.

Dissert. Abstr.

N69-29074 Northwestern Univ., Evanston, Ill.
KINETICS AND MECHANISM OF SUBSTITUTION REACTIONS OF DINITROSYLDICARBONYLIRON(0)
Donald Eugene Morris (Ph.D. Thesis)
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 69-1698

Dinitrosyldicarbonyliron(0) undergoes carbon monoxide substitution reactions in the presence of phospines, phosphites, and triphenylarsine to give the monosubstituted derivatives, $Fe(NO)_2(CO)L$. The preparation and spectra of several mono and disubstituted derivatives are reported. The rates of these reactions depend on the concentration and nature of the reagent. For reagents with the same donor atom the rates of reaction increase with increasing basicity (or polarizability) of the reagents. These results agree with what has recently been reported for $Co(NO)(CO)_3$. Therefore it is concluded that here also, as with the $Co(NO)(CO)_3$ system, polarizability and not basicity is the important factor for determining the rates of nucleophilic attack by the reagents on the metal atom. This is in accordance with the iron(0) being a class (b) or soft metal. The results obtained for the substitution reactions by these reagents support a bimolecular displacement mechanism with nucleophilic attack by the entering reagent on the iron.
Dissert. Abstr.

N69-29076 Stanford Univ., Calif.
REDUCTION OF CARBOXYLATOPENTAAMMINECOBALT (III) COMPLEXES BY CHROMIUM(II) AND VANADIUM(II) IONS
Martha Barcalow Barrett (Ph.D. Thesis) 1968 103 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 69-190

The reduction of carboxylato pentaammine cobalt(III) complexes by chromium(II) was investigated for the acetato-, benzoato-, formato-, chloroacetato-, dichloroacetato-, tri-fluoroacetato-, and pivalato pentaammine cobalt(III) complexes. The reaction was found in all cases to be first order in cobalt(III) complex and first order in chromium(II). The rate constants and activation parameters are reported. The protonation of the acetato pentaamine cobalt(III) ion is reported. The concentration stability constant for the protonation of the acetato complex is estimated to be 0.25 M^{-1} from an analysis of the acid dependence of the observed second order rate constant for the acetato pentaamine cobalt(III)–chromium(II) reaction in 1.0 M lithium perchlorate–perchloric acid mixtures.
Dissert. Abstr.

N69-29079# California Univ., Livermore. Lawrence Radiation Lab.
IMPROVEMENT OF CHEMICAL SEPARATIONS ON ION EXCHANGE RESINS: EFFECT OF GRAIN SIZE [AMELIORATION DES SEPARATIONS CHIMIQUES SUR RESINES ECHANGEUSES D'IONS: INFLUENCE DE LA GRANULOMETRIE]
G. Aubouin and J. Laverlochere [1968] 24 p refs Transl. into ENGLISH from J. Radioanal. Chem. (France), no. 1, 1968 p 123–137
(UCRL-trans-10324) Avail: CFSTI

In order to reduce the time requirement for ion-exchange separations the kinetics of the elution of different ions were studied as a function of the grain size of the ion-exchange resins. Using a countercurrent apparatus seven different fractions could be separated using Dowex 1 × 10 and 50 W × 12. Grain size had a great influence on the shape of the elution curves. The finer and more homogeneous the resins, the sharper are the peaks on the elution curves. These considerations were utilized for the separation of rare earths, alkali metals, and alkaline earth metals, respectively.
Author (NSA)

N69-29084# Naval Research Lab., Washington, D.C.
NUCLEAR APPLICATIONS PROGRAM Progress Report, 1 Jan.-31 Jul. 1968
E. A. Wolicki Aug. 1968 45 p refs
(AD-679077; NRL-MR-1932) Avail: CFSTI CSCL 7/5

A program of experiments in the application of nuclear techniques and facilities to problems in nonnuclear areas was initiated in the nuclear physics division in January of 1968. The program consists of two parts: (a) The analysis of materials using neutron or charged particle radioactivation or prompt radiation detection; and, (b) Ion implantation of energetic heavy ions into solids.
Author (TAB)

N69-29117# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires.
VITRIFICATION OF THE SOLID FLUORIDE RESIDUE ARISING FROM THE REACTION OF FLUORINE ON IRRADIATED FUEL [VITRIFICATION DES RESIDUS SOLIDES FLUORES PROVENANT DE LIATTAQUE PAR LE FLUOR DES COMBUSTIBLES IRRADIES]
R. Bonnisud and P. Labe 19 p In FRENCH Presented at the Symp. on Nonaqueous Reprocessing, Mol, Belgium, 28 Oct. 1968
(CEA-CONF-1196; CONF-681040-8)

The vitrification of residues from the fluoride attack on fuel elements was studied. The characteristics of the fluoride wastes from the reaction vessel and from the static filter are outlined. Tests were made on the complete coating of the wastes in a glassy solid block which would be stackable. The technique used was described, and the effect of the fluoride concentration on the vitrification process was determined. The physical characteristics of the glass with respect to thermal conductivity and mechanical resistance were satisfactory. The tests indicated that the volatile fluorides must be stabilized by their transformation into alkaline earth fluorides. The sillcophosphorated compositions were satisfactory for the coating.
NSA

N69-29120 Akron Univ., Ohio.
INTERSEQUENCE CYCLIZATION REACTIONS IN COPOLYMERS AND TERPOLYMERS
Norman Wilson Johnston (Ph.D. Thesis) 1968 172 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 68-17862

Thermally induced intramolecular intersequence cyclization reactions in methyl methacrylate–vinyl bromide copolymers, methyl methacrylate–vinyl chloride copolymers, and methyl methacrylate–vinyl chloride–styrene terpolymers were studied quantitatively. The extents of cyclization obtained are in good accord with those predicted from statistical considerations. Intramolecular intersequence cyclization reactions that occur on bromination of methyl methacrylate–butadiene copolymers were also studied quantitatively. The extents of cyclization, measured by a NMR technique, are in good accord with those predicted from statistical considerations. This thesis also describes a statistical treatment of terpolymer cyclization reactions and a graphical procedure for evaluating one set of monomer reactivity ratios in a terpolymer system knowing the other two sets, monomer feed compositions, and terpolymer compositions.
Dissert. Abstr.

N69-29122 Illinois Univ., Urbana.
INFRARED INTENSITIES IN SUBSTITUTED METAL CARBONYLS
Donald Jude Darensbourg (Ph.D. Thesis) 1968 158 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-1328

Infrared intensity measurements were made on a wide variety of substituted metal carbonyls in an attempt to gain a better

understanding of the bonding in these compounds. In interpreting the infrared intensities of the CO stretching modes in substituted metal carbonyls certain assumptions are usually made regarding the number of different characteristic localized MCO group moment derivatives for the various CO groups in a given complex. In this report the results are satisfactorily interpreted in terms of the assumption that each carbonyl stretching symmetry mode exhibits a characteristic MCO group moment derivative. The coupling between the two modes of A_1 symmetry in the mono-substituted complexes was examined and found not to depend significantly on whether M-C stretching force constant and various associated interaction constants are included in the vibrational analysis. Dissert. Abstr.

N69-29127 Delaware Univ., Newark.
THE GAMMA RADIOLYTIC DECOMPOSITION OF CYSTEINE AND RELATED COMPOUNDS IN DILUTE, AQUEOUS SOLUTION
Richard Merle Peterson (Ph.D. Thesis) 1968 122 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 68-17854

The radiation chemistry of the amino acid cysteine was investigated in aqueous solution, primarily at pH 1 in perchloric acid, air-free. Qualitative and quantitative analyses by simultaneous polarography during radiolysis, various spectrophotometric methods, and chromatographic analyses involving isotopically labelled C^{14} and S^{35} cysteine showed that Co^{60} gamma irradiation at a dose-rate of approximately 6×10^{16} eV/g per minute decomposes cysteine primarily into cystine, hydrogen sulfide, hydrogen and alanine. A mechanism is postulated based upon complete radical scavenging of the "primary" water radiolysis products. Dissert. Abstr.

N69-29139 Maryland Univ., College Park.
PERMEATION OF LIQUID CYCLOHEXANE-BENZENE MIXTURES THROUGH LOW DENSITY POLYETHYLENE FILM
Yuwah Chan (Ph.D. Thesis) 1968 139 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 69-714

A detailed study of the permeation properties of the cyclohexane-benzene-polyethylene system was made and the dependence of permeation upon diffusion coefficients and solubilities was examined. The work reported here is one of the few studies in which solubilities, permeabilities and diffusion coefficients have each been measured on a system thus permitting the interaction between the three to be determined. The solubility and diffusion coefficient were measured by using the desorption technique, while permeation studies and the determination of permeation rates were accomplished by means of a permeation cell. The effects of different liquid compositions and the effects of temperature over a range of 25° to 50°C were determined. Solubility results indicated that the component solubilities are strongly dependent upon the liquid compositions. Dissert. Abstr.

N69-29157 Northwestern Univ., Evanston, Ill.
SOLID STATE STUDIES OF FERROUS CHROMICYANIDE AND OTHER PRUSSIAN BLUE ANALOGUES
David Basset Brown (Ph.D. Thesis) 1968 135 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 69-1805

Cyanide linkage isomerism has been found to occur in the solid state for the polymeric complex of approximate composition $Fe_3[Cr(CN)_6]_2$. The combination of infrared spectroscopy, X-ray powder diffraction, magnetic susceptibilities, and Fe^{57} Mossbauer spectroscopy indicate that four distinct structures occur at different stages in the isomerization of this solid. The initial face-centered cubic material contains Fe^{+2}-N-C-Cr^{+3} linkages and has interstitial Fe^{+2}. In the first reaction step the interstitial Fe^{+2} displaces Cr^{+3} from the carbon octahedra to give a half-isomerized complex with a mixture of Fe^{+2} and Cr^{+3} in the carbon octahedra and Cr^{+3} in interstitial sites. In the presence of air, this complex undergoes further rearrangement and partial oxidation. The oxidized product can then be reduced to give the true linkage isomer, e.g., the complex containing Cr^{+3}-N-C-Fe^{+2} linkages with Fe^{+2} in interstitial sites. Dissert. Abstr.

N69-29158 Tennessee Univ., Knoxville.
ELECTRON SPIN RESONANCE AND OPTICAL STUDIES OF RADIATION-INDUCED TRAPPED ELECTRONS AND FREE-RADICAL INTERMEDIATES IN ORGANIC GLASSES
Jacob Wen-pin Lin (Ph.D. Thesis) 1968 196 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 69-1250

Trapped electrons were generated by either gamma irradiation or ultraviolet photoionization, and studied by optical and ESR detection methods. The assignment of the optical and ESR spectrum to the trapped electron has been verified by chemical and physical methods. Experiments have been carried out to investigate the properties, to determine the radiation-chemical yield, $G(e^-)$, and to follow the thermal decay of the trapped electrons. The trapped electron in irradiated hydrocarbon glasses and hydrocarbon-amine mixtures exhibits broad structureless absorption band in the near infrared region with λ_{max} near 1600 mμ. It is also characterized by an ESR singlet signal at $g = 2.002$, having a width of about 4 gauss and easily saturated by microwave power. Photobleaching by infrared light ($\lambda > 1$ μ) was observed to be a general effect for the trapped electron in these glasses. Dissert. Abstr.

N69-29167 Stanford Univ., Calif.
STEADY-STATE TRANSPORT IN NON-EQUILIBRIUM CHEMICALLY REACTING GASES
Christopher Chung-Yat Shih (Ph.D. Thesis) 1968 246 p
Avail: Univ. Microfilms: HC $11.25/Microfilm $3.20 Order No. 69-291

In reacting gas mixtures chemical reactions can contribute significantly to the rate of heat transfer, due to the diffusion of enthalpy flux as a result of the concentration gradient caused by the temperature gradient. The primary objective of the present theoretical investigation is to gain a better understanding of the effects of chemical reactions on the steady-state energy and mass transport in chemically reacting gases. The study is restricted to the case of a single, stoichiometric reaction in a perfect gas mixture with unidirectional fluxes. Non-equilibrium systems for both the case of identical and the case of unequal binary diffusion coefficients are considered. In the latter case, it is shown that the usual assumption of invariance of elemental composition is no longer valid because preferential diffusion takes place among different atomic species. Dissert. Abstr.

N69-29168 Virginia Univ., Charlottesville.
REACTIONS OF SOME POLYHYDRIC ALCOHOLS IN FUSED ALKALI METAL ACETATES
Louis Lasseter Burton (Ph.D. Thesis) 1968 84 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-18249

Polyhydric alcohols dissolved in fused alkali metal acetates and reacted at 200° forming volatile products under reduced pressure (0.2 mm Hg): α-methacrolein (26%), methanol (54%), and water (126%) from pentaerythritol; α-methacrolein (42%), methanol (42%), and water (44%) from trimethylolethane; and 2-ethylpropenal (24%), methanol (50%), and water (48%) from trimethylolpropane. The same volatile products were observed at 220°. Sublimed starting material was observed in all reactions. In the pentaerythritol reaction a nonvolatile residue formed in the fused salt. The pure polyhydric alcohols and fused salt were thermally stable at these temperatures. Dissert. Abstr.

N69-29170 Nebraska Univ., Lincoln.
THE REACTIONS OF α-AMINO KETONES
Donald Francis McLaen (Ph.D. Thesis) 1968 205 p
Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 68-18025

In a study of the reaction of α-amino ketones with nitrous acid it was found that two acid products were obtained: a cleavage acid, and a rearranged acid. When the α-amino ketones were nitrosated at low temperature (0°), moderate yields of diazo ketone could be isolated. The oxidation of α-amino ketones was carried out using a number of reagents, lead tetraacetate, sodium periodate, isodosobenzene diacetate, and tertiary butyl hypochlorite. When para substituted phenacylamines were oxidized with lead tetraacetate under a variety of experimental conditions, benzoyl-nitriles or products derived from the benzoylnitrile could be isolated in good yield, depending on the solvent used and the ratio of oxidant to amino ketone. The reaction of α-amino ketones with hydrazoic acid (Schmidt Reaction) was also studied. Dissert. Abstr.

N69-29171 California Univ., Davis.
STEREOCHEMISTRY OF ASYMMETRIC SILICON: THE SILICON-SULFUR BOND
Jerome McLick (Ph.D. Thesis) 1968 125 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-861

A family of optically active compounds containing silicon–sulfur bonds, R_3Si^*SR', where R_3Si^* denotes α-naphthyl-phenylmethylsilyl and R' = H, CH_3, C_6H_4–CH_3-*p*, and R_3Si^*, has been prepared. Relative and absolute configurations have been assigned to the compounds by means of stereochemical reasoning and chemical correlations. The results of this study afforded a direct stereochemical comparison of the silicon-oxygen bond with the silicon–sulfur bond. Substitution of sulfur for oxygen in R_3Si^*OR' causes a dramatic increase in reactivity and preferance for inversion of configuration for nucleophilic displacements. Further, the observed increased preference for inversion displacement of sulfur leaving groups, relative to the oxygen analogs, is seen to preclude any hypothesis which would attribute inversion stereochemistry of R_3Si^*X to high electronegativity of X and consequent preference of X for an apical position in an Si-5 intermediate. Dissert. Abstr.

N69-29172 Northwestern Univ., Evanston, Ill.
A TRIESTER APPROACH TO OLIGONUCLEOTIDE SYNTHESIS
Kelvin Kenneth Ogilvie (Ph.D. Thesis) 1968 91 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 69-1902

A new method was investigated for the preparation and purification of oligonucleotide derivatives on a relatively large scale. The basic feature of the method was that nucleotide chains were constructed with phosphotriester rather than phosphodiester links. In a final step blocking groups were removed to give the phosphodiester chains. The general approach is exemplified by the synthesis of the β-cyanoethyl ester of 5'-O-monomethoxytritylthymidylylthymidine (I). 5'-O-Monomethoxytritylthymidine-3' β-cyanoethyl phosphate was prepared and condensed with thymidine using triisopropylbenzenesulfonyl chloride in pyridine. The products were separated by silica gel column chromatography to give, in one large scale reaction, 39.3 grams of I which represented a 64.5% yield based on 5'-O-monomethoxytritylthymidine. Dissert. Abstr.

N69-29173 University of Southern Calif., Los Angeles.
DYNAMIC BEHAVIOR OF SOAP FILMS COMMENTS ON THINNING OF ISOLATED FILMS AND COLLAPSING OF BURST FILMS
Winnie Ruth McEntee (Ph.D. Thesis) 1968 217 p
Avail: Univ. Microfilms: HC $9.90/Microfilm $3.00 Order No. 69-626

Soap films serve as model colloidal systems for the investigation of factors influencing the stability of colloids. Among the factors of importance are the action and interaction of the London-van der Waals attraction; electrical double layer repulsion; gravitation; interfacial tension; and, possibly, structuring of solvent layers at the interfaces. These factors are investigated through the dynamic processes of the thinning of films to an equilibrium thickness and the collapsing of burst films. Each experiment was performed in an airtight enclosure with a saturated atmosphere. The aqueous solutions were above the critical micelle concentration of the detergent (except for the rigid film solutions). The detergent used was sodium lauryl sulfate or sodium dodecyl benzene sulfonate; the neutral salt to control ionic strength, sodium or lithium chloride; and an additive, if desired, lauryl alcohol or glycerol. Dissert. Abstr.

N69-29175 Rutgers Univ., New Brunswick, N.J.
RESOLUTION OF ENANTIOMERS BY REVERSED-PHASE CHROMATOGRAPHY AND COUNTERCURRENT EXTRACTION
Salvatore J. Romano (Ph.D. Thesis) 1968 107 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-17807

The objective of this research was to develop new methods for resolving enantiomers. Optically active liquid phases were used in reversed-phase chromatography and countercurrent extraction to resolve (±)-mandelic acid or sodium (±)-mandelate. Eight different optically active liquids were investigated as resolving agents for (±)-mandelic acid by batch extraction experiments. These compounds were (−)-menthone, (−)-carvone, (−)-menthyl acetate, (+)-di-n-butyl tartrate, (+)-camphor (in benzene), (−)-menthol (in benzene), (+)-glucose pentaacetate (in chloroform), and (−)-linalool. (−)-Carvone, the best of these, gave a separation factor of 1.025 for the enantiomers of mandelic acid. Attempts to adapt this system to the method of reversed-phase chromatography were unsuccessful. Styrenedivinylbenzene and kieselguhr were used as solid supports. Dissert. Abstr.

N69-29176 Clarkson Coll. of Technology, Potsdam, N.Y.
ACID-BASE EQUILIBRIA IN CONCENTRATED SALT SOLUTIONS
Augustus Donovan Saxton (Ph.D. Thesis) 1968 303 p
Avail: Univ. Microfilms: HC $13.75/Microfilm $3.90 Order No. 69-17956

Acid base equilibria of some singly positively charged and uncharged acids are studied in dilute acid-concentrated LiBr and LiCl solutions. The H_0 and log Q functions are defined. Pertinent contributions from previous investigators are summarized and some important applications of these functions are suggested. Experimental methods for evaluating H_0 and log Q are discussed along with solubility and distribution measurements as a means for determining the activity coefficients of uncharged species. Dissert. Abstr.

N69-29177 Vanderbilt Univ., Nashville, Tenn.
A FLASH PHOTOLYSIS STUDY OF THE NO_3 FREE RADICAL IN AQUEOUS NITRIC ACID SOLUTIONS AT ROOM TEMPERATURE
Robert William Glass (Ph.D. Thesis) 1968 422 p
Avail: Univ. Microfilms: HC $19.55/Microfilm $5.40 Order No. 68-17972

A study was made of the primary photochemical generation process and subsequent decay kinetics of the NO_3 free radical which is produced by flash photolysis of ceric ammonium nitrate, $(NH_4)_2Ce(NO_3)_6$, dissolved in room temperature solutions possessing a wide range of HNO_3 concentrations. An apparatus was developed which combines flash photolysis kinetic techniques with the use of a high field pulse-magnet to provide a means for studying the effects of magnetic fields >100 kilogauss on chemical systems involving fast reactions at room temperature. Using a sensitive magnetically shielded photomultiplier, small changes in absorption of transient species generated in the sample were monitored accurately. Preliminary investigations employing the NO_3 radical in aqueous HNO_3 solution revealed that fields of 150 kilogauss have no apparent effect on the primary process; however, such fields exhibited small retarding effects on the rate of the bimolecular process. Dissert. Abstr.

N69-29179 Northwestern Univ., Evanston, Ill.
A STUDY OF THE STABILITY OF A CONTINUOUS FLOW STIRRED TANK REACTOR WITH CONSECUTIVE CHEMICAL REACTION
David Stephen Sabo (Ph.D. Thesis) 1968 262 p
Avail: Univ. Micrifilms: HC $11.95/Microfilm $3.40 Order No. 69-1928

Stability analysis of a continuous flow stirred tank reactor with consecutive chemical reaction, A → B → C, was investigated here for the first time. Calculations show that from one to five steady states are possible. Integration of the system equations was performed using a CDC 3400 digital computer, and parts of the three dimensional phase space were generated for a system with one steady state and for a system with three steady states. Linearization of the system equations correctly predicted the phase space of the neighborhood of the steady states. For the system with three steady states, the surface separatrix was determined by preplanned integration of the system equations. Computer time of 1-1/2 hours was required to obtain the separatrix. This provided the impetus to develop other techniques to determine the regions of asymptotic stability. Dissert. Abstr.

N69-29233 North Carolina Univ., Chapel Hill.
PART 1: THE ELECTRONIC STRUCTURE OF ANTHRAQUINONE. PART 2: THE SPIN RESONANCE SPECTRA OF ELECTROCHEMICALLY GENERATED RADICAL ANIONS OF NITROGEN HETEROCYCLIC COMPOUNDS
Henry Robertson Drott (Ph.D. Thesis) 1968 210 p
Avail: Univ. Microfilms: HC $9.45/Microfilm $3.00 Order No. 69-1609

The polarizations of the transitions to the lowest n-π^* and three π-π^* singlet states of 9,10-anthraquinone have been measured relative to that of the phosphorescence by the method of photoselection. The n-π^* transition is negatively polarized to the $T1 \rightarrow S0$ emission and has been assigned to be polarized along the Y molecular axis. Y is the axis in the molecular plane perpendicular to the carbonyl axis. The anion radicals of pyrazino(2,3-b)pyrazine, 2,3,6,7-tetramethyl pyrazino(2,3-b)pyrazine quinoxalino(2,3-b)-quinoxaline, and 5,12-dihydroquinoxalino-(2,3-b)quinoxaline, oxaline have been generated electrochemically and the electron spin resonance spectra recorded. The simulated ESR spectra and stick diagrams were generated from measured coupling constants. Comparison of the spin densities to related compounds has exhibited basic similarities. Dissert. Abstr.

N69-29242 Akron Univ., Ohio.
SYNTHESIS AND PHYSICAL BEHAVIOR OF BLOCK POLYMERS
James Edward McGrath (Ph.D. Thesis) 1967 163 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 68-17865

Synthesis, characterization and physical behavior of A-B-A block polymers of polystyrene (A) and polyisoprene (B) have been studied in considerable detail. Block polymers were prepared by sequential addition of the monomers to an anisole-ethyl lithium-benzene system. Rigorous purification methods and high vacuum techniques were employed. Sharp, single peaked gel permeation chromatograms on A-B-A block polymers were proof that little or no homopolymer or diblock polymer was present. The effects of block lengths and composition on the ultimate properties were studied at constant center block length and constant end block length. The effect of center block distribution was also investigated. A moderate amount of center block polydispersity did not affect the strength properties when the tests were run over a wide strain rate and temperature scale. Dissert. Abstr.

N69-29243 North Carolina Univ., Chapel Hill.
PART 1: MASS SPECTRAL STUDIES OF SUBSTITUTED FERROCENES. PART 2: ATTEMPTED OBSERVATION OF THE MAGNETIC ANISOTROPY IN FERROCENES
Durward Thomas Roberts Jr. (Ph.D. Thesis) 1968 111 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-1669

An unusual type of mass spectral decomposition of esters, loss of aldehyde, is found in certain ortho-substituted ferrocenylbenzenes and ω-ferrocenylalkanoates. The reaction is interpreted in the ferrocenylbenzenes in terms of a mass spectral ortho-effect with different geometrical requirements from those previously noted, and suggests that there may be general class of ortho-effect reactions not predictable by the six-membered ring rule. The reaction in ω-ferrocenylalkanoates loses formaldehyde when n = 0, 2, and 3 after loss of the unsubstituted cyclopentadienyl ring. An attempt was made to place rigid groups in the shielding volume of the ferrocene unit using several different cyclization procedures in hopes of observing an up field shift in the nmr of each compound as compared to a reference compound. Dissert. Abstr.

N69-29244 Akron Univ., Ohio.
STRUCTURE-PROPERTY RELATIONS OF STYRENE-BUTADIENE-STYRENE BLOCK POLYMERS
Peter Carmen Juliano (Ph.D. Thesis) 1968 246 p
Avail: Univ. Microfilms: HC $11.25/Microfilm $3.20 Order No. 68-17863

Block polymers of styrene-butadiene-styrene (SBS) were prepared with well-defined molecular characteristics. The major classes of variables considered to relate structure to properties were: (1) block polymers with block lengths of narrow molecular weight distribution, and (2) block polymers with broadened molecular weight distributions. Within each of the above series, the variables of constant composition, constant end-block length, and constant center-block length were studied. The effect of impure A-B-A block structure was also examined by solution blending A or AB blocks with an A-B-A block polymer. The results are in accord with the mechanism proposed for the strengthening, i.e., the yielding of the glassy regions. Preliminary experiments were also carried out in the morphology of these polymers, by electron microscopy. Dissert. Abstr.

N69-29266 Pennsylvania Univ., Philadelphia.
DILUTE SOLUTIONS OF MERCURY IN LIQUID BINARY ALLOYS
John Willis Burlingame (Ph.D. Thesis) 1968 208 p
Avail: Univ. Microfilms: HC $9.45/Microfilm $3.00 Order No. 69-70

Liquid binary alloys were equilibrated with mercury vapor between 300° and 500°C by a dynamic vapor-phase equilibration

method. Performance of the vapor-phase equilibration apparatus was checked by measuring the vapor pressure of pure mercury between 70° and 200°C. The determined vapor pressures gave a third law heat of -14.664±.15 cal/mole at 298°K. Equilibrated alloys were analyzed for mercury content by a gravimetric hot-extraction method. Effect of equilibration time and cooling rate of the alloys on the amount of mercury absorbed was studied. At 400°C, the activity coefficient of liquid mercury at infinite dilution in Sn, Pb, Bi, In, Tl, 50Sn–50Pb, 50Sn–50Bi, 50Sn–50In, 50Bi–50Pb and 50Bi–50Tl alloys was found to be 1.61, 1.45, 1.58, 0.283, 0.822, 1.23, 1.36, 0.631, 1.44 and 1.43, respectively.
Dissert. Abstr.

N69-29277 Boston Univ., Mass.
REARRANGEMENTS OF METHYL DIHYDROPYRAN AND CARBON-14 LABELLED DIHYDROPYRAN OVER HOT ALUMINA
Ieva Ruks (Ph.D. Thesis) 1968 367 p
Avail: Univ. Microfilms: HC $16.65/Microfilm $4.70 Order No. 68-18111

The research was undertaken to see whether tetrahydropyran might be an intermediate in the dihydropyran carbon scrambling process. In addition, the use of substituent methyl group instead of carbon-14 as a label in the rearrangements of tetrahydrofurfuryl alcohol and dihydropyran was examined. In the 5,6-dihydro-4H-pyran rearrangement, previous work showed that 3,4-dihydro-2H-pyran is not an intermediate but that 2-hydroxytetrahydropyran does give 5,6-dihydro-4H-pyran. To check for the possible intermediacy of tetrahydropyran, a solution of tetrahydropyran-2-^{14}C and 5,6-dihydro-4H-pyran was exposed to alumina at 350° under conditions that effected 89% carbon-14 scrambling in 5,6-dihydro-4H-pyran-6-^{14}C. The radioactivities of the emergent tetrahydropyran and dihydropyran were determined and compared to the activities expected with tetrahydropyran involved and with tetrahydropyran not involved as an intermediate.
Dissert. Abstr.

N69-29278 California Inst. of Tech., Pasadena.
CARBON-13 MAGNETIC RESONANCE SPECTROSCOPY
Frank Julian Weigert (Ph.D. Thesis) 1968 251 p
Avail: Univ. Microfilms: HC $11.50/Microfilm $3.25 Order No. 69-540

High resolution, natural abundance ^{13}C spectra have been obtained from a wide variety of organic compounds; ^{13}C chemical shifts and coupling constants have been correlated with other molecular properties. Geminal and vicinal, carbon-proton couplings in benzene and the five- and six-membered aromatic heterocycles have been related to the corresponding proton-proton couplings in substituted ethylenes. The carbon-proton coupling constants in benzene are $J_{CCH} = +1.0$, $J_{CCCH} = +7.4$ and $J_{CCCCH} = -1.1$ Hz. Extended Huckel wavefunctions are uniformly poor in explaining the long-range, carbon-proton couplings in aromatic systems. Couplings between carbon and elements other than hydrogen have been observed in proton decoupled ^{13}C spectra. All of the carbons in fluorobenzene and 1-fluoronaphthalene, but only six of the carbons in 2-fluoronaphthalene are coupled to the fluorine.
Dissert. Abstr.

N69-29279 Northwestern Univ., Evanston, Ill.
SUBSTITUENT AND SOLVENT EFFECTS IN THE RAMBERG-BAECKLUND REACTION
Mark Dennis Wolfinger (Ph.D. Thesis) 1968 271 p
Avail: Univ. Microfilms: HC $12.40/Microfilm $3.50 Order No. 69-1968

The effect of substituents on the rate of the Ramberg–Backlund reaction has been investigated. The reaction is accelerated by electron-withdrawing groups at either the α- or α'-position. Methyl groups at the α-position have little effect on the rate. That α'-methyl groups also have little effect on the reaction rate, even though they decrease the rate of carbanion formation by over 100-fold per methyl group, is attributed to decreased carbanion solvation. The poorly solvated carbanion is a powerful nucleophile and rapidly displaces the halide. Halogen substituents at the α- or α'-position accelerate the reaction, as is expected for electron-withdrawing substituents. The literature was searched for data on the effect of substitutents on a verity of ring-closure reactions. The interpretation of the data resulted in dividing ring-closure reactions into categories based on the mechanism of the ring-closure. The effect of solvent on the Ramberg-Bäcklund reaction of benzyl α-chlorobenzyl sulfone has also been determined. Increasing the dioxane content of an aqueous dioxane system increases the rate (86-fold faster in 80% dioxane than in water).
Dissert. Abstr.

N69-29281*# Pennwalt Corp., King of Prussia, Pa. Research Dept.
NONFLAMMABLE, ANTISTATIC, AND HEAT-SEALABLE FILM
G. H. Dahl, J. P. King, O. S. Sprout, Jr., P. M. Thomas, and B. P. Block 31 May 1969 34 p refs
(Contract NAS9-8356)
(NASA-CR-99695) Avail: CFSTI CSCL 07C

Antistatic, heat-sealable, self-extinguishing films were prepared from polyvinylidene fluoride and polyvinylidene chloride resins. These films were 2.5, 4, and 6 mils thick. Numerous compounds were studied as internal antistatic additives in cast films and as additives to resinous surface coatings. Conductive laminates, 4 and 7 mils thick, were prepared by heat pressing a wire mesh or a printed silver grid between films of polyvinylidene fluoride. Static properties were evaluated by two different methods and at different levels of humidity. Films containing either pyridinium, ammonium chloride derivatives, or conductive grids were found to have static propensities of less than 5 nanocoulombs at 57% relative humidity and dissipation times of 0.6 to 2 sec for a 5 kv charge both at 50% and at less than 15% relative humidity. Water resistance and mechanical properties were also studied for these films. Author

N69-29282 Maryland Univ., College Park.
TRIVALENT PHOSPHORUS DERIVATIVES OF THE GROUP VIB METAL CARBONYLS
Patrick Richard McAllister (Ph.D. Thesis) 1968 158 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-721

Phosphorus containing derivatives of the Group VIB metal carbonyls were studied with the emphasis on the synthesis, phosphorus-31 nuclear magnetic resonance spectra and infrared spectra in the carbonyl region of these compounds. The type compounds included in the study are $LM(CO)_5$, cis and trans-$L_2M(CO)_4$, facial-$L_3M(CO)_3$, facial-(dipyridyl)-$LM(CO)_3$ and meridional-$(Ph_2PCHCH_2PPh_2)LM(CO)_3$, where M is chromium, molybdenum, or tungsten and L is a tertiary phosphine, tertiary phosphite, halophosphine, or alkoxyphenylphosphine. A total of 66 compounds were prepared for the study. Phosphorus-31 nuclear magnetic resonance spectra were obtained for 93 compounds, of which 63 were prepared and isolated for the first time; 20 were previously prepared compounds which had not been isolated or characterized by ^{31}P spectra; and 10 were compounds which were identified by ^{31}P spectra but which were not isolated or otherwise characterized.
Dissert. Abstr.

N69-29285 Rutgers Univ., New Brunswick, N.J.
DIELECTRIC PROPERTIES AS RELATED TO CRYSTAL STRUCTURE OF LEAD ZIRCONATE-LEAD TITANATE PIEZOELECTRIC CERAMICS

James Richard Buckmelter (Ph.D. Thesis) 1968 141 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-17752

A well-known anomaly exists in the lead zirconate–lead titanate solid solution system at a morphotropic phase boundary between rhombohedral and tetragonal phases. This morphotropic phase boundary exists at a $PbZrO_3$–$PbTiO_3$ molar ratio of 53:47, and dielectric properties such as piezoelectric coupling coefficients and dielectric constant are maximum near this ratio. The effects of minor additions to lead zirconate–lead titanate at and near this 53:47 ratio were investigated using dielectric and crystal structure data. Initial work showed that highest planar coupling coefficients could be obtained with Nb^{5+} additions and lowest electromechanical loss with Fe^{3+} additions. Inasmuch as these additions are of interest because of the enhanced dielectric properties, the effects of these additions to other $PbZrO_3$–$PbTiO_3$ ratios were studied. Dissert. Abstr.

N69-29286 California Univ., Davis.
PHOTOREACTION ENGINEERING: CHLORINATION OF PROPANE
Alberto Enrique Cassano (Ph.D. Thesis) 1968 526 p
Avail: Univ. Microfilms: HC $23.85/Microfilm $6.70 Order No. 69-842

The design of photoreactors for complex reaction sequences was formulated. An additional equation of change, the conservation of radiation energy, was necessary to describe the system. A complete definition of the problem required proper formulation of the boundary conditions. At the reactor wall, the boundary condition must account for surface reactions with the active centers. Also, for a tubular reactor radiated from outside, the boundary condition at the center of the tube takes a special form. For chain kinetics, the complexity of the mathematical formulation and the lack of knowledge of many design parameters prevented the exact solutions. The main unknowns are the specific reaction rate constants for the elementary steps and the diffusivities of the active intermediates. For isothermal, laminar flow, low optical-density system, and differential reactor operation the design equations were simplified. Dissert. Abstr.

N69-29296 Pennsylvania Univ., Philadelphia.
A PHYSICO-CHEMICAL STUDY OF SILICON AND PHOSPHORUS DERIVATIVES OF TETRACARBONYLCOBALT HYDRIDE
Surinder Kumar Gondal (Ph.D. Thesis) 1968 331 p
Avail: Univ. Microfilms: HC $15.10/Microfilm $4.25 Order No. 69-108

The purpose of the investigation was to: (1) investigate methods for synthesizing a Si-Co bond, (2) study the structures of any such compounds synthesized, (3) study selected chemical reaction of the Si-Co bond and, where possible, the mechanism of such reactions, and (4) investigate the structure, chemical properties, and thermochemical properties of a series of compounds of general formula $HCo(CO)_x(PF_3)_{4-x}$ ($x = 0$ to 4). The $CH_3SiH_2Co(CO)_4$ was synthesized in 47.5% yield by the reaction of CH_3SiH_3 with $Co_2(CO)_8$ at room temperature. The compound $CH_3SiF_2Co(CO)_4$ was made by the reaction of $CH_3SiH_2Co(CO)_4$ with PF_5 or by the reaction of $Co_2(CO)_8$ with a mixture of CH_3SiH_3 and PF_5, at or below room temperature. Dissert. Abstr.

N69-29301 Vanderbilt Univ., Nashville, Tenn.
ELECTRON SPIN RESONANCE STUDIES OF IRRADIATED POLYTETRAFLUOROETHYLENE
Chun-Fu Chen (Ph.D. Thesis) 1968 93 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-17964

Electron spin resonance (ESR) spectra of polytetrafluoroethylene (PTFE) x-irradiated were attributed to the propagating radical $S_3(-CF_2)$, the chain radical $2S_5(-CF_2-CF-CF_2-)$, and a single broad line when irradiated in vacuum, or the peroxy radicals when irradiated in air. The α, β, γ hyperfine splitting of the double quintet are respectively 91, 32, and 3.5 oersted. The triplet spectrum becomes a well-resolved triple triplet at 160°C. The spectrum of peroxy radicals consists of an asymmetric singlet $O_I(-CF_2-CFOO-CF_2-)$ and a symmetric singlet $O_{II}(-CF_2-OO)$. The S_3 and $2S_5$ radicals and the O_I and O_{II} radicals were separated. The spectra of O_I and O_{II} radicals were found to be either symmetric or asymmetric depending on the orientation of the chain axis with respect to the magnetic field. S_3 radical becomes a well-resolved triple triplet when its chain axis is perpendicular to the magnetic field. Dissert. Abstr.

N69-29304 California Univ., Irvine.
REACTIONS OF 2.8 eV TRITIUM ATOMS WITH METHANE
Chun-chao Chou (Ph.D. Thesis) 1968 145 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-753

Tritium atoms with 2.8 ev laboratory energy produced by photodissociation of TBr at 1849 A were allowed to react with methane. Both the abstraction reaction to form HT and the substitution reaction to form CH_3T were observed. The HT/CH_3T ratio in Br_2-scavenged systems is 3.8 ± 0.4 at low Br_2 mole fractions and decreases to 3.0 ± 0.2 at high Br_2 mole fractions. The HT/CH_3T ratio is related to the reaction cross sections for the abstraction and the substitution reactions. Crude estimates combined with the HT/CH_3T ratio of 0.8 and 50% hot yield in recoil tritium reactions with methane, suggest that about 10% of the substitution reaction and half of the abstraction reaction in recoil tritium systems occur below 2.8 ev. A nonequilibrium state mechanism for low energy tritium atom reactions is proposed to explain the observed results in the photochemical systems. Dissert. Abstr.

N69-29317 Tennessee Univ., Knoxville.
SOME ELECTRONIC PROPERTIES OF SOLUTIONS IN SOLID MATRICES
Orvin Edson Wagner (Ph.D. Thesis) 1968 101 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 69-127

Dielectric constants of greater than 10^6 have been observed for salt filled porous insulators. The dielectric constant and conductivity were both found to vary exponentially with $1/T$, where T is the absolute temperature. Experimental results indicate that the slope of the log dielectric constant versus $1/T$ curve, in the low moisture limit, is proportional to the ionic dissociation energy of the included molecule. The slopes of the log resistivity versus $1/T$ curves were found to be proportional to the ionic dissociation energy plus the ionization energy of either the cation or anion included in the matrix. Thermoelectric measurements indicated positive or negative carriers with probable hole or electronic conduction. The presence of some water together with the Maxwell–Wagner interfacial mechanism are hypothesized as responsible for the charge separation that produces the large polarizabilities. Dissert. Abstr.

N69-29319 George Washington Univ., Washington, D.C.
LANTHANIDE IONS AS SENSITIVE PROBES IN INTERMOLECULAR ENERGY TRANSFER AND ORGANIC PHOTOCHEMISTRY
George William Mushrush (Ph.D. Thesis) 1968 124 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-701

Characteristic trivalent lanthanide ion fine fluorescence is emitted when the rare earth ion and an appropriate organic sensitizer are present as nonassociated co-solutes. This ionic

fluorescence is the result of an efficient intermolecular collisional energy transfer process from the broad absorbing organic sensitizer to the nonchelated metallic ion. The process involves: (1) organic sensitizer absorption from the ground singlet to excited singlet states, (2) intersystem crossing to the lowest triplet state, (3) collisional transfer of excitation energy to the rare earth ion, and (4) ionic fluorescence. Competing processes are the radiationless deactivation of the organic triplet and/or of the excited lanthanide ion and photochemical reaction with the solvent when operative. A large number of different types of organic compounds were evaluated for sensitization properties. Dissert. Abstr.

N69-29322 Northwestern Univ., Evanston, Ill.
SOME STUDIES OF THE ULTRAVIOLET SPECTRUM OF PHENYLGERMANE AND OF THE CHEMISTRY OF GOLD
James Melvin Meyer (Ph.D. Thesis) 1968 88 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-1893

A study of the intensities of the $^1A_{1g} \rightarrow {}^1B_{2u}$ transitions in substituted phenylgermanes has led to the conclusion that germanium participates in dπ–pπ bonding. Comparison of the relative intensities of the spectra of silicon and germanium compounds shows silicon to be more effective in pi bonding than germanium. Attempted preparations of a complex of the type L–Au–Au–L are discussed. Although these preparations were not successful, the possibility of its future preparation is not excluded. Complexes of the stoichiometry $[((C_6H_5)_3P)_2AuX]$ are prepared. Evidence is given for the existence of the bis(triphenylphosphine)gold(I) cation. Infrared, molecular weight, and conductivity measurements demonstrate a dissociative equilibrium for these complexes in solution. Dissert. Abstr.

N69-29323 Northwestern Univ., Evanston, Ill.
ISOTOPE EFFECTS IN ACETYLACETONE AND LEWIS ACID-BASE ADDUCTS OF BETA-DIKETONES, PARTS 1 AND 2
David Wallace Thompson (Ph.D. Thesis) 1968 160 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-1958

Isotope effects in acetylacetone were investigated by proton magnetic resonance infrared spectroscopy, and ultraviolet spectroscopy. Partial substitution of deuterium at the terminal methyl groups and at the 3-position in the keto tautomer shifted the proton resonance peaks up-field. The change in the keto–enol tautomeric equilibrium resulting from deuterium substitution at the methylene carbon was measured at various temperatures. The enthalpy change for enolization of the protium-containing compound is more negative than for the deuterium-containing compound. Adducts of Group IV tetrahalides with acetylacetone, 3-methylacetylacetone, and 3,3-dimethylacetylacetone were prepared and characterized. Analytical, nuclear magnetic resonance and infrared data are consistent with the compounds being simple 1:1, non-ionic adducts. Dissert. Abstr.

N69-29324# Tennessee Univ., Knoxville. Dept. of Chemistry.
EMF, VOLTAMMETRIC AND SPECTROPHOTOMETRIC MEASUREMENTS ON THE U(IV)/U(III) COUPLE IN MOLTEN LITHIUM FLUORIDE BERYLLIUM FLUORIDE ZIRCONIUM FLUORIDE
H. W. Jenkins, G. Mamantov, D. L. Manning, and J. P. Young 1969 2 p
(Contract AT(40-1)-3518)
(PB-182653; ORO-3518-11) Avail: CFSTI CSCL 07D

The standard potential of the U (IV)/U(III) couple was calculated with respect to a hypothetical unit mole fraction Ni/Ni (II) electrode from emf measurements on the galvanic cell Pt;U (IV), U (III)::Ni (II)/Ni. The cell consisted of a Ni/Ni (II) reference electrode contained in a boron nitride compartment and a Pt wire immersed in a melt containing U (III) and U (IV). U (IV) and U (III) concentrations were determined spectrophotometrically in fused salt samples taken in graphite windowless cells. The absorbance of U (IV) was determined at 640 nm and that of U (III) at 360 or 890 nm depending on its concentration level. Measured cell potentials were corrected, using the Nernst equation. The corrected potentials were plotted versus log U (IV)/U (III). USGRDR

N69-29325 Illinois Univ., Urbana.
CALORIMETRIC STUDIES OF HYDROGEN-BONDED ADDUCTS
Troyl David Epley (Ph.D. Thesis) 1968 121 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-1339

Measurements of the thermodynamics of hydrogen-bond formation between four phenolic acids and a wide range of Lewis bases in non-aqueous solvents are described. Several methods of enthalpy and equilibrium constant determinations solely by use of solution calorimetry are developed and critically compared with other available techniques. Special attention is given to the use of an anisole analogue of the phenol to correct for non-hydrogen-bonding interactions. The determined enthalpy values are used to establish quantitative correlations with the (O–H) bond wave number shift upon coordination and with the Hammett substituent constants of the phenolic acids. The impact of these enthalpies and accompanying correlations on the Drago–Wayland linear enthalpy relationship is considered and both the qualitative and quantitative significance of the resulting C and E parameters are discussed. Dissert. Abstr.

N69-29326 Delaware Univ., Newark.
POLYMERIZATION AND COPOLYMERIZATION CHARACTERISTICS OF 1,2-DIMETHYL-5-VINYL PYRIDINIUM METHYL SULFATE
Daniel Joseph Monagle (Ph.D. Thesis) 1968 304 p
Avail: Univ. Microfilms: HC $13.75/Microfilm $3.90 Order No. 68-17849

The polymerization and copolymerization of 1,2-Dimethyl-5-vinyl pyridinium methyl sulfate (DMVPMS) yield water-soluble high molecular weight polyelectrolytes. This research was undertaken with the objective of accurately determining the various monomer. The information gained from this effort should prove valuable for the preparation of a class of cationic polyelectrolytes whose molecular structure can be uniformly controlled and characterized. The copolymerization parameters of DMVPMS were calculated by the method of non-linear regression wherein the average mole fractional monomer compositions were employed together with the average copolymer compositions. Dissert. Abstr.

N69-29340 Tennessee Univ., Knoxville.
THERMODYNAMIC PROPERTIES OF AQUEOUS BINARY MIXTURES OF HYDROCHLORIC ACID WITH A SERIES OF METAL CHLORIDES AS CALCULATED FROM ELECTROMOTIVE FORCE MEASUREMENTS
Harold A. O'Brien, Jr. (Ph.D. Thesis) 1968 148 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 69-1256

This study is part of an overall program of investigating the thermodynamic behavior of aqueous binary mixtures of acids and their salts over a wide range of temperature and concentration. In this work the values of the activity coefficient of HCl were determined by electromotive force measurements in HCl–KCl, HCl–RbCl, HCl–CsCl, HCl–$MgCl_2$, HCl–$CaCl_2$, HCl–$SrCl_2$, and HCl–$AlCl_3$ mixtures, using both high-temperature autoclave equipment and a constant-temperature bath. The experimentally determined

activity coefficients at each data point were fitted simultaneously by a least squares technique to an equation containing a Debye–Hückel term and ion-interaction parameter terms. For each system, the assumption that the activity coefficient could be expressed by the sum of these terms was tested by back-calculating the cell electromotive force. Good agreement between the observed and calculated values was obtained. Dissert. Abstr.

N69-29341 Stanford Univ., Calif.
NUCLEAR MAGNETIC RESONANCE STUDIES OF ANISOTROPIC MOLECULAR ROTATIONAL DIFFUSION IN LIQUIDS. A STUDY ON THE APPLICATION OF ION-CYCLOTRON MAGNETIC RESONANCE TO PROBLEMS IN PREBIOTIC SYNTHESIS
Wesley Theodore Huntress, Jr. (Ph.D. Thesis) 1968 274 p
Avail: Univ. Microfilms: HC $12.40/Microfilm $3.55 Order No. 69-233

The equations for the relaxation time of a nuclear spin in a molecule undergoing diffusional reorientation in a liquid have been extended to include fully anisotropic reorientation for a number of relaxation mechanisms. The full rotational diffusion tensor, both principal diffusion constants and orientation of the principal rotation axes, can be found by the measurement of the NMR relaxation times of an appropriate set of nuclei in the molecule. Nuclei which relax by the quadrupolar mechanism appear uniquely suited for a study of molecular reorientation. The modern speculations on the origin of organic chemicals of biological significance from the inorganic components of the newly-formed earth's primitive atmosphere have been summarized, and the importance of hydrogen cyanide as a reactive intermediate linking the inorganic and organic is stressed. Dissert. Abstr.

N69-29361 Northwestern Univ., Evanston, Ill.
ADSORPTION OF ETHANE IN MOLECULAR SIEVE PARTICLES
Carl Richard Antonson (Ph.D. Thesis) 1968 276 p
Avail: Univ. Microfilms: HC $12.60/Microfilm $3.55 Order No. 69-1787

This investigation was undertaken in order to study the molecular sieve adsorption of ethane from helium in an isothermal packed bed system. Of prime importance were the effects of nonlinear (Langmuir) equilibrium isotherms and cylindrical particle shape. Several possible internal mechanisms were studied. In all cases, the adsorption model assumed intraparticle diffusion control where equilibrium was established at the fluid–solid interface. For various forms of the model, theoretical breakthrough curves were generated numerically using finite difference techniques. To test the model, experimental breakthrough curves were generated for six different types of molecular sieve particles. Analysis of the curves for cylindrical particles showed that the diffusion coefficients were the same as those for spherical particles when the height to diameter ratios ranged from 0.5 to 5.0. Dissert Abstr.

N69-29382 Pennsylvania Univ., Philadelphia.
STUDIES IN THE ORGANOMETALLIC CHEMISTRY OF GROUP IV ELEMENTS
Gerald Berkowitz (Ph.D. Thesis) 1968 113 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-64

The object of this research was the extension and expansion of work done in the heterocyclic chemistry of compounds containing more than one Group IV hetero-atom. Attempts were made to synthesize new heterocyclics of silicon, germanium and tin of the type $[R_2MCH_2]_n$ where R = OC_2H_5, CH_3, H.; M = Si, Ge, Sn and n = 2,3.... NMR assignments are given for all the above new compounds. IR assignments are given for all new compounds isolated which do not contain an ethoxy-group and Mass spectral fragmentation patterns are given for bromomethyldimethylbromogermane, bromoethyltrimethylgermane, and 1,1,3,3-tetramethyl-1,3-digermacyclobutane. Dissert. Abstr.

N69-29383 Carnegie-Mellon Univ., Pittsburgh, Pa.
SYNTHESIS AND STUDY OF SOME NEW GERMANIUM HYDRIDE DERIVATIVES
Gerst Alan Gibbon (Ph.D. Thesis) 1968 139 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 68-17648

Mercury sensitized photolysis techniques have been applied to the synthesis of volatile hydride derivatives of carbon, silicon, and germanium. The new compounds germyl methyl ether, GeH_3OCH_3, and germyl methyl silane, $GeH_3SiH_2CH_3$, have been prepared by the mercury photosensitized decomposition of GeH_4–CH_3OH and GeH_4–CH_3SiH_3 mixtures respectively. The compounds have been characterized by their infrared, mass, and nuclear magnetic resonance spectra. Other physical and chemical properties of GeH_3OCH_3 have also been determined. In addition, the Lewis basicity of GeH_3OCH_3 has been measured relative to SiH_3OCH_3 and CH_3OCH_3 by an infrared hydrogen bonding study. Basicities are observed against method as a reference acid. Dissert. Abstr.

N69-29409 South Carolina Univ., Columbia.
INFRARED AND RAMAN INVESTIGATIONS OF MOLECULES WITH LOW FREQUENCY VIBRATIONS
Dennis William Wertz (Ph.D. Thesis) 1968 191 p
Avail: Univ. Microfilms: HC $8.80/Microfilm $3.00 Order No. 69-484

The infrared spectra of HNCS and DNCS have been reported. Two of the low frequency bending modes were identified for HNCS and reassignments were made. Assignment of the six fundamentals of DNCS are given and discussed. Gas phase analysis of the N–H stretching vibration gave an A rotational constant of 43.35 ± 0.5 cm^{-1} in the ground state and 38.67 ± 0.5 cm^{-1} in the first excited state. The infrared spectra of $(CH_3)_2PSCl$, $(CH_3)_2PSBr$, and $(CH_3)_2POCl$ have been observed. The Raman spectra have also been recorded and depolarization values measured. Assignment of the fundamental vibrations based on the depolarization values and frequencies have been given and discussed. An alternative explanation for one of the two bands of the proposed doublet of the P = S stretching mode is presented. Dissert. Abstr.

N69-29451 Delaware Univ., Newark.
DIRECT DETERMINATION OF INTERMOLECULAR POTENTIALS FROM PHYSICAL PROPERTY MEASUREMENTS
Jerome D. Robinson (Ph.D. Thesis) 1968 165 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 68-17850

A procedure is developed for determining intermolecular potentials from physical property measurements which uses formal definitions of properties from kinetic theory and avoids postulating the form of the potential. Although only second virial and self-diffusion coefficients were chosen for specific study, the procedure extends readily to all properties which can be expressed by kinetic theory. The problem is formulated so that a potential is sought which minimizes the deviations between calculated and measured properties. Variational analysis is used to establish necessary conditions for such minima and iteration procedures are used to determine potentials which satisfy these conditions. As part of this work, computer programs were developed which compute both virial and diffusion coefficients from numerical listings of the potential. Dissert. Abstr.

N69-29460 Case Western Reserve Univ., Cleveland, Ohio.
A CORRELATION OF THE THERMODYNAMIC PROPERTIES OF THE PERFLUOROALKANES AND MIXTURES OF NITROGEN WITH ARGON
John Henry Smith (Ph.D. Thesis) 1968 152 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-10205

The low temperature adiabatic calorimetry of molecular compounds which exhibit solid–solid disordering transitions is presented. The effects on the temperature and entropy of these transitions as resulting from systematic perturbations of the molecular lattice are examined. Specifically, the transitions of the perfluoroalkane series are correlated in the light of a systematic variation in the peripheral groups of the carbon tetrafluoride molecule; the transitions of nitrogen molecules in a molecular lattice diluted with varying amounts of argon are also examined. These two sections are considered separately. Heat capacity data for carbon tetrafluoride containing .015% impurity was determined from 12.88°K to 145.12°K. Dissert Abstr.

N69-29503# Air Force Systems Command, Wright-Patterson AFB, Ohio. Air Force Materials Lab.
KINETIC ANALYSIS OF THERMOGRAVIMETRY. PART 2: PROGRAMMED TEMPERATURE Technical Report, Jan. 1967–May 1968
Ivan J. Goldfarb, Robert McGuchan, and Alan C. Meeks Dec. 1968 91 p refs
(AD-684714; AFML-TR-68-181-Pt-2) Avail: CFSTI CSCL 7/4

A generally applicable method of obtaining kinetic parameters from temperature-programmed thermogravimetry is presented. Factors influencing the selection of a particular method for the numerous treatments reported in the literature are discussed in detail. The method of Friedman involving the use of several thermograms at different heating rates and determining Arhennius parameters at each percent conversion was chosen. The experimental procedure and a method of handling thermogravimetric analysis (TGA) data and calculations by computer are fully described. The application of the treatment to some specific polymer degradation systems is reported in order to illustrate the scope of the method and its potential usefulness in obtaining information concerning complex degradation mechanisms. Poly(tetrafluoroethylene), an aliphatic, and an aromatic polyamide were the polymers selected for this study. Author (TAB)

N69-29556# Air Force Systems Command, Wright-Patterson AFB, Ohio. Materials Lab.
PERTURBATION EFFECTS BETWEEN MULTIPLE BONDS Final Report, Jan. 1966–Jan. 1968
Ben Arthur Loving Feb. 1969 189 p refs
(AD-685185; AFML-TR-68-383) Avail: CFSTI CSCL 7/3

The interaction between sites of unsaturation in organic molecules spatially oriented to produce anomalies in their ultraviolet spectra were studied. The products, intermediates and mechanisms involved in reduction by sodium in liquid ammonia were considered. After preparation, 1-t-butyl-3, 3-dimethylcyclopropene and bicyclo(4.2.0)oct-7-ene were treated with sodium in liquid ammonia to evaluate strain effects. The former was completely reduced but the latter was unaffected. The unstrained cyclodec-5-en-1-one was readily reduced by this reagent to bicyclo(5.3.0)decane-1-ol. An attempted synthesis of cyclodec-5-en-1-one starting with 1, 6-cyclodecadiene led to a series of interesting transannular rearrangements. Bicyclo(2.2.1)hept-5-ene-2-one with one equivalent of sodium in ammonia afforded a high yield of a dimeric material, while a large excess of sodium gave reduction of the ketone group to the unsaturated alcohol. Tricyclo(1.1.1.0)hept-2-one on reduction gave bicyclo(2.2.1)hept-2-one. cis-Bicyclo(3.3.0)oct-7-ene-2-one was reduced to a mixture of the endo and exo-cis-bicyclo 3.3.0 oct-7-ene-2-ols. Reduction of (2.2)paracyclophane with sodium in liquid ammonia gave both 1, 4-dihydro and tetrahydro products. When ethanol as a proton donor was added the reaction proceeded by a different course to give 4,4-di-p-tolylethene. Author (TAB)

N69-29563# Georgia Inst. of Tech., Atlanta.
ION SWARM ANALYSIS INVOLVING DRIFT, DIFFUSION AND REACTIONS
Ian R. Gatland Dec. 1968 19 p refs
(Contract N00014-67-A-0226)
(AD-684480; GIT-4-PU) Avail: CFSTI CSCL 7/4

Solutions are obtained for the drift-diffusion-reaction equations describing ions released into a large gas filled region, subject to a uniform electric field, where the ions may change species by reacting with the gas. The two species, forward-backward reaction case is considered in detail. Author (TAB)

N69-29572*# National Aeronautics and Space Administration, Washington, D.C.
ON THE FIRE-EXTINGUISHING EFFICIENCY OF HALONES [UBER DIE LOSCHWIRKUNG VON HALONEN]
R. Fiala Jun. 1969 56 p refs Transl. into ENGLISH of Deut. Luft-und Raumfahrt, Forschungsbericht Rept. 68-16
(NASA-TT-F-12232) Avail: CFSTI CSCL 07C

Halones (halogenated hydrocarbons) are increasingly used as an extinguishing agent in fire-fighting burning fuels. The extinguishing properties of some of these halones, halone mixtures, and halone-carbondioxyde mixtures were compared. The reduction of the laminar burning velocity of a stoichometrical propane–air mixture effected per concentration unit of the extinguishing agent was applied as a standard for comparison. The influence of the initial flame conditions on the extinguishing efficiency of halones was also investigated, varying the fresh-gas temperatures, the kind of oxidizer, the oxidizer–fuel ratio, and the Reynolds number of the fresh gas flow. Author

N69-29577# California Univ., San Diego. Scripps Institution of Oceanography.
SOUND ABSORPTION IN ELECTROLYTE SOLUTIONS DUE TO CHEMICAL RELAXATION. PARTS 1 AND 2
Manfred Eigen et al 1 Oct. 1968 98 p refs Transl. into ENGLISH from German papers
(Contract Nonr-2216(05))
(AD-683325; SIO-REF-68-41) Avail: CFSTI CSCL 7/4

The theory of stepwise dissociation of an electrolyte is set forth quantitatively using linearized equations to obtain solutions for relaxation times and maximum values of ultrasonic absorption per wavelength in terms of normal coordinates. Application of the theory to experimental results of sound absorption of 2-2 electrolytes is discussed and it is shown how to obtain numerical results for reaction rate constants and equilibrium constants. Comparison of results for alkaline earth metals and the first group of transition metals leads to some conclusions about formation of metal complexes. The mechanism consists of a gradual substitution of the solvent molecules in the different coordination shells of the metal ions, involving various effects such as ion-dipole interaction, dipole-dipole interaction, field stabilization of the ligands and stereospecific effects. Author (TAB)

N69-29585# Scientific Translation Service, Ann Arbor, Mich.
CONTRIBUTION TO THE STUDY OF THE SYSTEM (U,Pu)C,N
Robert Lorenzelli [1968] 71 p refs Transl. into ENGLISH from French report CEA-R-3536 Sponsored by AEC
(ORNL-tr-3019; CEA-R-3536) Avail: CFSTI

The reactions of UC, PuC, (U,Pu)C, UC_2 and $U(C_{1-x}O_x)$ with nitrogen at room temperature to 400°C are described. The influence of the uptake of nitrogen by the powders on the nature of the final product has been investigated; it has been shown that the sintered carbides are hyperstoichiometric. The reactions of carbon with UN, PuN, and (U,Pu)N have also been studied. Under vacuum, carbon reacts on the nitrides at temperatures as low as 1100°C; nitrogen is replaced by carbon and the final product is a carbonitride. The reaction is: $MN + x\,C \rightarrow MN_{1-x}C_x + (x/2)\,N_2$. The reaction is limited and the carbonitrides have a fixed composition in presence of M_2C_3 or MC_2; hence it is impossible to produce pure MC using the reaction. The ternary diagrams U-C-N, Pu-C-N, and (U,Pu)C-N have been drawn. They show clearly that it is possible to obtain single phase carbonitrides in a wide domain of compositions. Author (NSA)

N69-29605# Naval Research Lab., Washington, D.C.
THE INTERACTION OF RADON DECAY PRODUCTS WITH AEROSOLS Interim Report
A. W. Saunders, Jr., R. L. Patterson, Jr., and L. B. Lockhart, Jr. 4 Sep. 1968 26 p refs
(AD-684437; NRL-6802) Avail: CFSTI CSCL 7/5

An instrumented plastic chamber was constructed and used to study the stability of some submicron dioctyl phthalate (D.O.P.) aerosols and their interaction with the short-lived radioactive decay products of radon (222Rn). The degree of attachment of the radon decay products to the D.O.P. aerosols in this chamber has been shown to be a function of the relative areas of the aerosol and wall surfaces. At high aerosol concentrations (100,000 particles/cu cm), 90% or more of the short-lived decay products are attached to aerosol particles. At lower aerosol concentrations and particularly when convection increases the availability of the walls for deposition, the airborne radioactivity is much less. Under the proper conditions appreciable quantities of unattached radon descendants will remain airborne. A few preliminary studies with these free atoms or simple molecules have shown that they are effectively retained by fibrous filters. They thus provide a useful tool for evaluating the retentivity of filter media toward extremely small particles and for studying the mechanism of particle capture through diffusive processes. Author (TAB)

N69-29625# Naval Research Lab., Washington, D.C.
WETTING OF LOW-ENERGY SURFACES BY NONAQUEOUS SOLUTIONS OF DIMETHYL SILOXANE-CONTAINING OR FLUOROCARBON-CONTAINING SURFACTANTS Interim Report
W. D. Bascom, Laura A. Halper, and N. L. Jarvis 27 Feb. 1969 15 p refs
(AD-685194; NRL-6808) Avail: CFSTI CSCL 7/4

The wetting of low-energy solid surfaces by nonaqueous solutions has been investigated with solutions of copolymers of dimethylsiloxane-ethylene oxide and solutions of fluorocarbon-containing surfactants. The organic liquids studied were propylene carbonate, bis(2-ethylhexyl)sebacate, isopropylbiphenyl, and a partially chlorinated biphenyl. Surface-tension-vs-concentration isotherms were determined for the surfactants in these liquids. The solid surfaces studied were stearic acid and 11-(perfluorodecyl)undecanoic acid monolayers on stainless steel, polyethylene, and Teflon. In nearly all instances, the surfactants produced a marked improvement in the wetting of the low-energy surfaces by the organic liquids; however, they did not cause spontaneous spreading of the organic liquids on the smooth, solid surfaces, even when when the solution surface tensions were depressed below the critical surface tensions of wetting of the solids. The failure of these surfactants to cause spontaneous wetting appears to be related to (a) the adsorption of the surfactant at the organic-solid/air interface and (b) the failure of the surfactants to significantly reduce the organic-solid/organic-liquid interfacial tensions. Author (TAB)

N69-29628# Naval Research Lab., Washington, D.C.
VAPOR-PHASE OXIDATION OF HYDROCARBONS. PART 2: EFFECT OF OXYGEN CONCENTRATION ON PLATINUM-CATALYZED COMBUSTION AND IONIZATION Interim Report
F. J. Woods, M. E. Umstead, and J. E. Johnson Feb. 1969 18 p refs
(AD-684072; NRL-6816-Pt-2) Avail: CFSTI CSCL 7/3

The catalytic combustion of hydrocarbons has been studied further, with particular attention given to the ionization phenomena associated therewith. The greater ion yield of highly branched alkanes relative to straight-chain alkanes was confirmed. The effect of the concentration of O2 in the gas mixture on the extent of oxidation and ionization varied with the hydrocarbon used. In general, increase in O2 content caused considerable enhancement of the ion yield. However, with some hydrocarbons the fraction oxidized decreased markedly with increased O2 concentration. The data seem consistent with an explanation based on lower temperature oxidation occurring only on the Pt surface, whereas at higher temperatures the catalytic process extends itself to some degree into the vapor phase. It is also suggested that dissociative adsorption of O2 at higher temperatures is involved in the ion-producing process. Author (TAB)

N69-29629# Army Foreign Science and Technology Center, Washington, D.C.
NEW FIBER-FORMING POLYAMIDES
O. Ya. Fedotova, M. I. Shtilman, and G. S. Kolesnikov Mar. 1969 10 p refs Transl. into ENGLISH from Khim. Volokna (Leningrad), v. 10, 1968 p 5–7
(AD-684487; FSTC-HT-23-665-68) Avail: CFSTI CSCL 7/5

Polyamides have been obtained in yields of 92-95% from the unsaturated 8-dodecene-1, 12-dicarboxylic and 8, 10-hexadecadiene dicarboxylic acids ethylenediamine, hexamethylenediamine, and decamethylenediamine. The polyamide from 8-dodecene-1, 12-dicarboxylic acid and hexamethylene-diamine yields fiber with which, after irradiation with gamma-rays from 60Co at a dose of 2.7 Mrad/hr., showed a breaking strength of up to 33.1 km and an elongation of 23%, compared with values of 20.3 km and 25% for the unirradiated fiber. Author (TAB)

N69-29667*# National Aeronautics and Space Administration, Washington, D.C.
NEW DEVELOPMENTS IN THE ADAPTATION OF COBALT CATALYSTS TO THE SYNTHESIS OF GASOLINE [NEUES UBER DIE EIGNUNG VON KOBALTKATALYSATOREN FUER DIE BENZINSYNTHESE]
F. Fischer et al Jun. 1969 17 p refs Transl. into ENGLISH from Brennstoff-Chem. (Essen), v. 13, 1932 p 61–68
(NASA-TT-F-12205) Avail: CFSTI CSCL 07C

By increasing the activity of cobalt catalysts, the yield of liquid hydrocarbons was increased from 100 cc to 153 cc per m^3 of mixed gas, corresponding to 71% of the theoretical, while keeping constant the amount of gas passing over a unit of catalyst weight. This was accomplished by using precipitation rather than decomposition of nitrates employed previously, and by the use of kieselguhr as carrier. A cobalt +18% thorium oxide catalyst precipitated with potassium carbonate and a cobalt +15% manganese catalyst precipitated with sodium carbonate were found to have identical activity. The effect of the precipitant was studied and the optimum kieselguhr-to-metal ratio and the most effective amounts of added promoters were established. Copper addition brings about a decrease in reduction temperature. Regeneration of the catalyst based on extraction of the accumulated paraffin restores the catalysts to their original activity. The extent of which a cobalt catalyst gives rise to carbon dioxide in addition to water depends strongly on the operating temperature. Author

N69-29670*# Wisconsin Univ., Madison. Dept. of Mechanical Engineering.

THEORY OF DROPLET VAPORIZATION IN THE REGION OF THE THERMODYNAMIC CRITICAL POINT

Jose A. Manrique 2 Jun. 1969 198 p refs

(Grant NGR-50-002-017)

(NASA-CR-72558) Avail: CFSTI CSCL 07D

Analysis of the vaporization of a spherical droplet in a stagnant inert atmosphere including property variations with temperature and pressure and surface regression is applied by numerical computation to the case of liquid carbon dioxide vaporizing in gaseous nitrogen. Ambient temperatures of 375°–1600° K and pressures of 70 to 120 atmospheres were used in the calculations. Nonideal effects are shown to be important. It is shown that for sufficiently high pressures no steady state exists and that a droplet can reach and exceed its critical temperature by an intrinsically unsteady process. Comparisons are made with low density film theories and film theory with properties corrected for nonideal effects. Some calculations of the effects of sinusoidal pressure oscillations on vaporization are also included. Author

N69-29708*# Unified Science Associates, Inc., Pasadena, Calif.

GASEOUS ELECTROLYTES FOR BATTERIES AND FUEL CELLS Final Report, 21 Aug. 1964–31 Jul. 1967

S. Naiditch Jul. 1967 94 p refs

(Contracts NAS7-326; NAS7-437)

(NASA-CR-101642) Avail: CFSTI CSCL 07D

The properties of dense gaseous electrolytes were studied regarding their application to energy conversion. Ammonia was used as the principal solvent due to its favorable critical properties. It was established that electrolytes using gaseous ammonia solvents perform well under equilibrium conditions. A typical dynamic process, the plating of silver from a silver nitrate ammonia solution, was used to study the differences in liquid electrolyte–electrode and dense gaseous electrolyte–electrode interactions. Measurement were also made of the conductivity of dense gaseous silver nitrate ammonia solutions. These measurements were carried out in conjunction with theoretical studies of dense gaseous electrolytes. The solvation of Cs^+ the ionization of the salt cesium chloride in ammonia were subjected to a detailed theoretical examination. Author

N69-29709*# Whittaker Corp., San Diego, Calif. Narmco Research and Development Div.

THE DEVELOPMENT OF STRUCTURAL ADHESIVE SYSTEMS SUITABLE FOR USE WITH LIQUID OXYGEN Summary Report, 1 Mar.–30 Nov. 1967

Jerome Hollander Dec. 1967 53 p refs

(Contract NAS8-11068)

(NASA-CR-61743; SR-5; SR-V) Avail: CFSTI CSCL 07C

Work centered on the preparation of fluorinated polyurethanes. Two polyurethanes synthesized from the polyether of perfluoropropylene oxide showed promise. The polyurethane prepared from tetrafluoro-m-phenylene diisocyanate and this polyether has insufficient bond strengths unless prepared with catalyst, and then its pot life is too short. The polyurethane prepared from 1-chloro-2,4-diisocyanato 3,5,6-trifluorobenzene and the perfluoropropylene oxide polyether appears to meet the requirements. Bonds with this adhesive meet strength requirements at both room temperature and −320°F if the system is prepared either by reacting the diisocyanate with the polyether or by using the isocyanate-terminated prepolymer. Two other polyurethanes were synthesized from the polyether of hexafluorobenzene and hexafluoropentanediol, and either tetrafluoro-m-phenylene diisocyanate or 1-chloro-2,4-diisocyanato 3,5,6-trifluorobenzene. Prepared without catalyst their bond strengths were poor, with catalysts their pot lives were too short. Synthetic studies were carried out on the polyether of perfluoropropylene oxide and the polyether of hexafluorobenzene and hexafluoropentanediol. A new diisocyanate, 1-chloro-2,4-diisocyanato 3,5,6-trifluorobenzene, was synthesized. Author

N69-29714# Centralny Instytut Informacji Naukowo-Technicznej i Ekonomicznej, Warsaw (Poland). Scientific Publications Foreign Cooperation Center.

KINETICS OF THE REACTION BETWEEN URANIUM OXIDE AND IRON (III) IONS IN SULFURIC ACID

Jerzy Sobkowski et al *In its* Nukleonika, vol. 11, no. 11/12, 1966 1967 p 8–15 refs (See N69-29712 16-24)

Avail: CFSTI

The rate of the reaction between U_3O_8 and Fe(III) ions in sulfuric acid solutions was investigated by the method of determining rate constants. The progress of the reaction was followed in terms of changes in the Fe(III) concentration, determined by measuring the potential of a platinum electrode immersed in the reaction mixture. Both potentiometric and polarographic determinations were made. Data concerning the rate of dissolution of U_3O_8 samples in molar sulfuric acid, investigated at varying initial Fe(III) concentrations and various temperatures, and concerning the effect of stirring on the rate of the oxidation of U_3O_8, are presented graphically and discussed. For comparison purposes, several experiments were also made in perchloric acid solutions and the observed reactions were found to be slower than those in sulfuric acid. P.A.B.

N69-29715# Centralny Instytut Informacji Naukowo-Technicznej i Ekonomicznej, Warsaw (Poland). Scientific Publications Foreign Cooperation Center.

TRITIUM ISOTOPE EFFECTS IN THE OXIDATION OF HYDROGEN AND METHANE

Mieczyslaw Zielinski *In its* Nukleonika, vol. 11, no. 11/12, 1966 1967 p 16-18 refs (See N69-29712 16-24)

Avail: CFSTI

With the aim of confirming the interpretation that the C–H bound rupture is the rate determining step in the oxidation of CH_4 by CuO, single triated methane was used as the isotopic molecule. The experimental results, indicating a confirmation, are presented and discussed. Tritium enrichment of triated hydrogen in oxidation by N_2O was also studied. The calculated data show the enrichment factor to depend only slightly upon temperature and to vary with the time of standing of the reaction mixture in the reaction vessel. P.A.B.

N69-29727# Louisiana State Univ., New Orleans. Dept. of Chemistry.

VISIBLE AND FAR INFRARED SPECTRAL STUDIES OF TETRAHEDRAL AND OCTAHEDRAL COMPLEXES IN NON-AQUEOUS SOLVENT SYSTEMS. PART 1: FAR INFRARED SPECTRA OF TETRACHLOROMETALLATES ($MCl_{4-x}^{(-x)}$) IN BENZENE

Mary L. Good, Ching-Chuang Chang, Dennis W. Wertz (S.C. Univ.), and James R. Durig (S.C. Univ.) [1968] 17 p refs

(Contract AT(40-1)-2576; Grant NSF GP-8429)

(PB-182643) Avail: CFSTI CSCL 07B

Several tetrachlorometallate ($MCl_{4-x}^{(-x)}$) complexes were prepared in benzene by reacting the solid metal salts with a solution of a long-chain, high molecular weight quaternary salt or an amine hydrochloride. The resulting complexes have been studied by far infrared spectrometry. Evidence of cation effects on the distortion of the anion have been observed. Force constant calculations have been carried out assuming a Urey–Bradley force field. For the complexes of the first row transition metals, the M–Cl force constants (stretch) are in the order Mn < Co > NiZn which is the same order as the ligand field stabilization energies in a tetrahedral field. For the Al, Ga, In series, the order of the force constants is Al > Ga > In as one would expect. Author (USGRDR)

N69-29731 Pennsylvania Univ., Philadelphia.
PHYSICAL CHEMISTRY OF MACROMOLECULES: PART 1: AN IMPROVED EXPERIMENTAL TECHNIQUE FOR THE STUDY OF POLYMER ADSORPTION. PART 2: POLY-(METHYL METHACRYLATE): CHAIN DIMENSION STUDIES
Peter Grant Sparks (Ph.D. Thesis) 1968 262 p
Avail: Univ. Microfilms: HC $11.95/Microfilm $3.40 Order No. 69-176

An improved experimental technique was developed to study polymer adsorption at the liquid–solid interface. The experimental apparatus consisted of a sensitive microbalance to which the adsorbent, in the form of a thin foil, was attached and continuously weighed under a liquid to 10^{-6} g. Adsorption data was obtained by introducing a given amount of polymer solution into the cell in place of solvent and measuring the change in the weight of the adsorbent. The adsorption of monodisperse polystyrene from benzene at 18°C onto an aluminum oxide foil was studied with our apparatus. Isotherms were obtained for two molecular weights by measuring the specific adsorption as a function of solution concentration, which ranged from 0.02 to 0.45 mg of polymer per gram of solution. Characteristically the isotherms rise rapidly to a plateau region which appears to flatten out with increasing solution concentration. In addition, intrinsic viscosity–molecular weight relationships were established for atactic and isotactic poly-(methyl methacrylate) in 2,2,3,3-tetrafluoropropanol at 25°C.
Dissert. Abstr.

N69-29808# National Bureau of Standards, Washington, D.C.
IONIZATION POTENTIALS, APPEARANCE POTENTIALS, AND HEATS OF FORMATION OF GASEOUS POSITIVE IONS
J. L. Franklin (Rice Univ.), J. G. Dillard (Rice Univ.), H. M. Rosenstock, J. T. Herron, K. Draxl et al Jun. 1969 292 p refs
(NSRDS-NBS-26) Avail: SOD $4.00

This is a compilation of ionization and appearance potentials of positive ions published from 1955 through June 1966. The compilation lists the ion formed, the parent species from which it was formed, the other products of the process, the threshold energy for the formation of this ion, and the method by which this data was obtained. Where feasible, the heat of formation at 298°K of the positive ion has been computed for each entry using auxiliary thermochemical data. From these computed values, best values were chosen.
Author

N69-29874# Naval Research Lab., Washington, D.C. Chemistry Div.
HYPOTHESIS OF SILOXANE DEGRADATION OF HIGH TEMPERATURE AND THE EFFECT OF CERIUM-BASED INHIBITOR
A. D. Britt and W. B. Moniz 13 Mar. 1969 15 p refs
(AD-685635; NRL-6880) Avail: CFSTI CSCL 7/3

The cerium-based inhibitor for extending gelation times of commercial silicones is considered from the standpoint of the relatively fixed proportions of reactants necessary for optimum stabilization. A connection is made between these fixed proportions and the hydride/silanol content of the commercial silicone itself. The release of H2O by the high-temperature condensation of silanol groups does not lead to the simple evolution of H2O vapor but rather to a rapid catalytic attack by H2O on the siloxane chain. The beneficial effects of the cerium inhibitor can be rationalized in terms of eliminating the source of high-temperature H2O evolution.
Author (TAB)

N69-29900# Air Force Systems Command, Wright-Patterson AFB, Ohio. Materials Lab.
THE ABSORPTION AND REFLECTION CHARACTER OF INFRARED BANDS OF POWDERED INORGANIC MATERIALS Technical Report, Mar.–Sep. 1968
Conrad M. Phillippi Jan. 1969 59 p refs
(AD-685187; AFML-TR-68-317) Avail: CFSTI CSCL 7/4

The report approaches the problem of inconsistencies in the infrared spectra of powdered inorganic materials from the standpoint of optical physics. It shows that reflection losses predominate in the KBr pellet spectra of such materials and that many of the bands do not have the absorption character ordinarily associated with organic infrared spectra. The report reviews the underlying optical principles, compares the single crystal reflection spectra with the powder transmission spectra of 14 various oxides and fluorides of both lattice and molecular crystals and, by use of the oscillator parameters derived from dispersion analysis, develops a set of rules for interpreting powder spectra bands in terms of their absorption or reflection character. The primary conclusions of the report are that powder spectra have their greatest value for materials identification by spectrum matching, and that gross errors can arise from overusing these spectra by making vibrational assignments at each of the transmission minima.
Author (TAB)

N69-29906# Naval Ammunition Depot, Crane, Ind.
THE EFFECT OF SELECTED CONTAMINANTS ON THE HYGROSCOPICITY OF SODIUM NITRATE
William L. Ridley Mar. 1969 123 p refs
(AD-685628; NAD-CR-RDTR-140) Avail: CFSTI CSCL 19/1

A preliminary screen is made of the effects of 75 contaminants on the hygroscopicity of sodium nitrate. Results indicate that contaminants exert a significant effect both in increasing and in decreasing hygroscopicity. Various side effects are noted, for example the pronounced anticaking effect of zirconium sulfate and other compounds.
Author (TAB)

N69-29945# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE POSSIBILITY OF USING ALKYLANAPHTHOLS AS ANTIOXIDANTS
G. D. Kharlampovich et al 11 Jul. 1968 11 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Khim. i Khim. Tekhnol. (Moscow), v. 10, no. 7, 1967 p 789–791
(AD-685002; FTD-HT-23-459-68) Avail: CFSTI CSCL 7/4

Earlier research has shown that compounds of the naphthalene series display more favorable oxidation inhibiting properties than the compounds of the phenol series. In this research individual alkylnaphthols were synthesized and their oxidation inhibiting properties were investigated. It was shown when methyl groups are introduced into alpha- and beta-naphthols the oxidation inhibiting property of the alkylnaphthol series increases. The oxidation inhibiting property is further enhanced by the introduction of an isopropyl group. The position of the methyl group in the napthol series has a significant effect on the oxidation inhibiting properties of alkylnaphthols. In this connection it was found that 4-methyl-1-naphthol and 6-methyl-2-naphthol have the strongest oxidation inhibiting properties. Among other compounds 7-methyl-1-naphthol, 4-methyl-1-naphthol and 5-isopropyl-7-methyl-1-naphthol are superior in their oxidation inhibiting properties to the antioxidants which are presently used in industry and may be new effective chain reaction inhibitors. In this investigation the oxidation inhibiting property of a substance was evaluated from the effect which it produces on the induction period of oxidation of paraffin at 170C.
TAB

N69-29966# Naval Research Lab., Washington, D.C.
THE CARBON DIOXIDE PULSE TECHNIQUE FOR DETERMINING RESIDUAL GAS LIFE OF CHARCOAL BEDS. PART 1: BENCH-SCALE STUDIES
A. Stamulis and J. K. Thompson 31 Dec. 1968 28 p refs
(AD-684070; NRL-6793-Pt-1) Avail: CFSTI CSCL 7/1

The CO_2 pulse method for determining the remaining adsorptive capacity, or residual gas life, of adsorbent charcoal beds has been carried out on a bench scale. This method depends on the dispersion, or broadening, of the CO_2 concentration pulse, or elution peak, when a dose of the gas is swept through the bed. A clean charcoal bed causes considerable dispersion of the elution peak; a fully spent bed has little effect. A partially spent bed broadens the elution peak to an extent which depends on the amount of adsorptive capacity remaining. This dispersion of the elution peak is essentially insensitive to relative humidity over the range from 10 to 70%. This method permits the nondestructive, in-place determination of residual gas life of a charcoal bed without interrupting its normal operation. Author

N69-29959# Ohio State Univ., Research Foundation, Columbus.
BASIC RESEARCH ON THE SEPARATION OF SCANDIUM YTTRIUM, AND THE RARE EARTHS BY SOLVENT EXTRACTION Final Report
Thomas R. Sweet, Henry W. Parlett, Alcide L. Porell, William Kahn, and Samuel D. Blair Dec. 1968 128 p refs
(Contract AF 33(615)-3441)
(AD-685238; ARL-68-0210) Avail: CFSTI CSCL 7/4

The solvent extraction behavior of scandium, yttrium, and a number of rare earth metals was investigated. Pure 2,2,6 tetramethyl 3,5 heptanedione, hereafter referred to as H(thd), was used as the chelating agent and the organic solvent. In addition, the closely related reagent, 1,1,1-trifluoro-5 5-dimethyl 2,4-hexanedione, hereafter referred to as K(fdhd), was studied as a reagent for separating europium and terbium by countercurrent distribution extractions. Atomic absorption as a method of analysis for the rare earths was also investigated. Author (TAB)

N69-29971# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
ELECTRON SPIN RESONANCE STUDIES ON RADICALS PRODUCED FROM ORGANIC INCLUSION COMPOUNDS BY ELECTRON BOMBARDMENT [ELEKTRON-SPIN RESONANZ-UNTERSUCHUNGEN VON DURCH ELEKTRONENBESTRAHLUNG ERZEUGTEN RADIKALEN AUS ORGANISCHEN EINSCHLUSS VERBINDUNGEN]
G. Juppe, R. Fantechi, and G. A. Helcke 1969 35 p refs In GERMAN; ENGLISH summary
(EUR-4233.d) Avail: CFSTI

The radiolysis of unsubstituted and methylsubstituted aromatic compounds is discussed with regard to intermediate formation of radicals, their structure and reactivity, and the possibility of their observation with electron spin resonance methods. A method is described which makes possible the observation of well resolved electron spin resonance spectra from short lived radicals produced during fast-electron irradiation of inclusion compounds of organic molecules. This technique has the advantage that substances whose liquids have a dielectric absorption in the microwave region can be studied at temperatures well above their freezing points. Irradiation of diethylether absorbed in a molecular sieve has given a well resolved spectrum of the ethyl radical at +150°C and irradiation of cyclohexane as a thiourea adduct has given the spectrum of the cyclohexyl radical at room temperature. The observation of the benzyl radical during the irradiation of toluene adsorbed in a molecular sieve at −30°C is also described. Author

N69-29982# Technische Hochschule Hannover (West Germany). Fakultaet fuer Mathematik und Naturwissenschaften.
THE EFFECT OF FORCED SPEED FLUCTUATIONS ON A WALL REACTION GOVERNED BY MATERIAL TRANSPORT IN A FLOW TUBE, USING THE EXAMPLE OF CATALYTIC ETHYLENE HYDROGENATION [DER EINFLUSS ERZWUNGENER GESCHWINDIGKEITS SCHWANKUNGEN AUF EINE STOFFTRANSPORTBESTIMMTE WANDREAKTION IM STROEMUNGSROHR]
Albert Renken (Ph.D. Thesis) 1968 144 p refs In GERMAN
Avail: CFSTI

Acoustic wave effects on mass transport properties were observed during catalytic ethylene hydrogenation and sulfur dioxide oxidation in a tubular reactor with catalytically active inner walls. It was found that sonic excitation increased mass transfers and reaction velocities correspondingly to wave intensities at small frequencies. A potential function was formed to describe this sonic attenuation effect. Mass transfer measurements during acoustic catalytic sulfur dioxide oxidation were inconclusive because of the high sulfur dioxide diffusion coefficient in oxygen. Transl. by G.G.

N69-29983# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
SOLUBILITY OF TERPHENYLS AND OM_2 MIXTURES IN PURE AND TECHNICAL SOLVENTS
G. Mosselmans and J. Nienhaus 1969 55 p refs
(EUR-4228.e) Avail: CFSTI

The solubility of terphenyls and OM_2 mixture in pure and technical solvents is studied. Results are presented on curves where the weight percent terphenyl or OM_2 versus temperature is plotted. The results allow some considerations about the influence of the structure and the nature of functional groups on the solvent ability. Finally a selection of solvent is made for decontamination purposes. Author

N69-29985# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
HEATS OF FORMATION OF CHLORINE FLUORIDES [CHALEURS DE FORMATION DES FLUORURES DE CHLORE]
Paul Barberi, Jacques Caton, Jacques Guillin, and Olivier Hartmanshenn Mar. 1969 39 p refs In FRENCH; ENGLISH summary
(CEA-R-3761) Avail: CFSTI

The enthalpies of formation of the chlorine fluorides ClF, ClF_3 and ClF_5 have been determined by combustion calorimetry in hydrogen. They have respective values of 13.8, 37.2 and 57.2 Kcals.mole. Two bomb calorimeters with differing principles (high-frequency spark bomb and double compartment bomb) have been developed for this purpose. Author (ESRO)

N69-29992# North Carolina Univ., Chapel Hill.
DIFFUSION OF CALCIUM 45 IN AgCl [DIFFUSION DU CALCIUM 45 DANS AgCl]
Lawrence Slifkin and Gilbert Brebec (CEA, Saclay) Paris CEA Apr. 1969 14 p refs In FRENCH; ENGLISH summary
(CEA-R-3770) Avail: CFSTI

The diffusion of calcium in silver chloride has been studied. The activation energy was found to be constant in the temperature range 250–440°C which corresponds to a single diffusion mechanism, probably due to vacancies. Author (ESRO)

N69-29995# Atomic Energy of Canada, Ltd., Pinawa (Manitoba). Whiteshell Nuclear Research Establishment.
THE DETERMINATION OF VAPOUR PRESSURES OF ORGANIC LIQUID REACTOR COOLANTS AT ELEVATED TEMPERATURES
R. B. Stewart and G. G. Smith Nov. 1968 26 p refs
(AECL-3183) Avail: Atomic Energy of Can., Ltd., Chalk River, $1.00

A method is described for the high temperature measurement of the vapor pressures of polyphenyl-base reactor coolants. It is widely applicable to other organic and aqueous liquid samples and

can be used at temperatures up to 500°C and at pressures up to 500 psia. Two variations of the technique are described. One uses a fixed volume sample cell, applicable to single component measurements, and the other a cell with a very small controlled void volume, applicable to multicomponent mixtures. Data may be taken manually or by recorded scans. Corrections can be made for pressure increases due to pyrolytic decomposition of the organic liquid at high temperatures. Samples may be laboratory loaded or sampled in closed vessels under in-system conditions. Author

N69-30006# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.

ANALYTICAL CONTROL OF URANIUM MONOCARBIDE [CONTROLE ANALYTIQUE DU MONOCARBURE D'URANIUM]

J. L. Collin and H. Laurent Apr. 1969 94 p refs In FRENCH; ENGLISH summary

(EUR-4068.f) Avail: CFSTI

This report presents: (1) the synthesis of analytical studies to control the composition of uranium monocarbide; (2) the statistical examination of certain results; (3) the treatment of information obtained; and (4) the description of methods used. Author

N69-30042*# National Aeronautics and Space Administration, Washington, D.C.

DETERMINATION OF REACTION RATES OF COMPLEX REACTIONS

Reiji Mezaki (Yale Univ.) Jun. 1969 14 p refs Transl. into ENGLISH from Kagaku Kogaku (Tokyo), v. 32, no. 9, 1968 p 868–870

(NASA-TT-F-12269) Avail: CFSTI CSCL 07D

A steady state method for determining the rate constants in complex reactions is presented. It consists of deriving the rate equations by neglecting the time variation of concentrations of intermediate products, when the reaction involves intermediate products such as free radicals which are highly reactive. B.P.

N69-30089# Colorado Univ., Boulder.

THE SYNTHESIS OF SPECIAL FLUORINE-CONTAINING MONOMERS Final Report, 1 Dec. 1965–15 Mar. 1968

J. D. Parker and J. R. Lacher Natick, Mass. Army Natick Labs. Jul. 1968 113 p refs *Its* Ser. C&OM-51

(Contract DA-19-129-AMC-869(n))

(AD-684923; TR-69-17-CM) Avail: CFSTI CSCL 7/3

A large number of fluorine-containing intermediates were synthesized and submitted for further polymer studies. Among the organic fluorine compounds synthesized were (a) various bicyclobutenyl derivatives, (b) Grignard reaction products, (c) perhalocycloalkenes containing vinylic halogens (I, Br, Cl, F) and (d) vinylic mono- and di-carboxylic acids of perhalocycloalkenes. Author (TAB)

N69-30098# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.

ANALYTICAL METHODS FOR GASES USING IONIZATION [METHODES ANALYTIQUES DES GAZ PAR IONISATION]

Bruno Toudoire Apr. 1969 29 p refs In FRENCH; ENGLISH summary

(CEA-BIB-135) Avail: CFSTI

After a brief review of the principles of the analytical methods for gases used mainly in gas-phase chromatography, a more detailed description is given of the systems based on ionization such as the (a) argon detector, (b) electron capture detector, (c) flame ionization detector, (d) mobile electron detector, (e) ionization cross-section detector, (f) combination of a mass spectrometer with an ionization detector. A table is also given of the principal ionization detectors. A non-restrictive list of patents covering this topic is also given. Author (ESRO)

N69-30099# Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires.

PROPERTIES OF URANIUM (III) AND URANIUM (IV) IN SOLUTION (WATER, NON-AQUEOUS SOLVENTS, MOLTEN SALTS) [PROPRIETES DE L'URANIUM (III) ET DE L'URANIUM (IV) EN SOLUTION (EAU, SOLVANTS NON AQUEUX, SELS FONDUS)]

Nicole Petit Feb. 1969 77 p refs In FRENCH; ENGLISH summary

(CEA-BIB-141) Avail: CFSTI

This bibliography has been carried out with the help of F.E. Croxton's report which gathers together references concerning uranium and its compounds over the period 1789–1950; the 'Nuclear Science Abstracts' have been searched for the period 1951–1967 inclusive; most of the articles were consulted in the original journals. This work attempts to summarize the main reactions involving solvency, oxidation reduction and the formation of uranium (III) and (IV) complexes in the various media under consideration. The characteristics of the absorption spectra of uranium (III) and uranium (IV) solutions are presented in table form, as are the values of the oxidation reduction potential of the couples U(IV)/U(III), U(III)/U(0), and the formation constants for the complexes formed by uranium (IV) with inorganic and organic anions. For each medium furthermore, the literature references are classified according to methods used. Author (ESRO)

N69-30107# National Science Foundation, Washington, D.C.

TRANSITION METAL COMPLEXES WITH METAL-METAL BONDS Annual Progress Report

R. B. King, K. H. Pannell, and C. R. Bennett Apr. 1968 8 p refs

(Grant NSF GP-7081)

Avail: Issuing Activity

New chemistry is reported in the reactions of cyclopentadienylmetal carbonyl derivatives with trivalent phosphorus ligands and in the preparation of polysilanyl derivatives of the metal carbonyls. Structural identification was made of the reaction product of molybdenum hexacarbonyl and 8,9-dihydroindene. It is also reported that the mass spectra of organometallic compounds were interpreted and published. M.H.E.

N69-30119# Tokyo Univ. (Japan).

OXIDATION CATALYSIS AND THE ADSORBED STATE OF OXYGEN ON ZINC OXIDE

H. Horiguchi, M. Setaka, K. M. Sancier, and T. Kwan [1968] 10 p refs Presented at the 4th Intern. Congr. on Catalysis, Moscow, 1968

Avail: CFSTI

Changes in the electron spin resonance (ESR) signal due to adsorbed oxygen and of the residual oxygen pressure were simultaneously measured when O_2 on ZnO was heated up to 500°C. From the interdependent relationship of these changes, it was tentatively concluded that oxygen is transforming according to $O_2 \rightarrow O^-_2 \rightarrow 2O^- \rightarrow 2O^{2-}$. Chemical reactivities of some of the adsorbed oxygen species with H_2, CO and NO were investigated by an ESR method. The H_2–O_2 reaction on ZnO was investigated by a gas circulating method with special attention to the hydrogen isotope effect. The reaction took place 1.4–2.0 times faster with H_2 than with D_2 above 120°C while no isotope effect was found below 100°C. The results are correlated and discussed in terms of the oxidation-reduction mechanism. Author

N69-30152# Defence Research Board, Ottawa (Ontario). Defence Scientific Information Service.
DETERMINATION OF Mg AND Ca IN URINE AFTER ION-EXCHANGE CHROMATOGRAPHY
Ye. I. Pokrovskaya et al Jan. 1969 3 p refs Transl. into ENGLISH from Lab. Delo (Moscow), no. 4, 1968 p 243–244
(T-509-R) Avail: Issuing Activity

A method for determining the magnesium and calcium content of urine is described. The technique utilizes the strongly acidic, polystyrol sulfo-cation exchanger, KU–2×20, which has a high resolving capacity regarding urine cations. The displacement series for it is: $Na+ < NH_4+ < K+ < Mg++ < Ca++$. As a result, the elution of Mg and Ca is affected with solutions of potassium salts; in order to conjoin the cation elution and regenerations cycles, the experiment was operated with the K+ form of the ion exchanger. Tabulated results of the urine mineralization are included.
A.C.R.

N69-30172# Stanford Univ., Calif. Dept. of Computer Science.
HEURISTIC DENDRAL: A FAMILY OF LISP PROGRAMS
Georgia Sutherland [1969] 48 p refs
(Contract ARPA SD-183)
(AD-685612; SU-AI-80) Avail: CFSTI CSCL 09/2

The Heuristic Dendral program for generating explanatory hypotheses in organic chemistry is described as an application of the programming language LISP. The description emphasizes the non-chemical aspects of the program, particularly the topologist which generates all tree graphs of a collection of nodes.
Author (TAB)

N69-30181# Joint Publications Research Service, Washington, D.C.
MIXED-BED APPLICATIONS OF ION EXCHANGE
Vladimir Lvovich Bogatyrev 10 Jun. 1969 92 p refs Transl. into ENGLISH from the book "Onity v Smeshannom Sloye" Moscow, Khimiya, 1968 p 137–209
(JPRS-48200) Avail: CFSTI

A literature review is presented on the general principles and features of the use of ion exchanger mixtures in specific chemical processes. Detailed consideration is given only to the most interesting and methodologically general studies. Specific topics covered include: deionization of water; purification of nonelectrolytes and weakly dissociated compounds; dissolution of difficult soluble compounds; obtaining new compounds; use in analytical chemistry; absorption of gases and vapors; and applications in food processing, biology, and medicine. Tables are appended detailing characteristics of commercially available ion exchangers, and an extensive bibliography is included.
K.R.G.

N69-30190# Electrotechnical Lab., Tokyo (Japan).
WATER VAPOR ADSORPTION AND WETTABILITY OF ORGANIC HIGH POLYMERS AND GLASSES
Koji Kawasaki Nov. 1968 50 p refs In JAPANESE; ENGLISH summary
(Rept-690) Avail: CFSTI

This paper presents results of experiments conducted on the surface properties of silica glass and polymers, and considers a possible mechanism of the interaction between solid surfaces and water molecules from a macroscopic point of view. The relationship between water vapor adsorption, surface electrical conductivity, and characteristic adsorption states of water molecules on silica glass surfaces are discussed. Results of studies on the interaction between polymers and water vapor through the measurements of water vapor sorption isotherms, diffusion of water vapor in the polymer, electrical conductivity, and extension of polymer by the sorption of water vapor are presented. Measurments on the change of the wettability of organic solid polymers in contact with water and the sliding of water drops down tilted polymer slides were made for the purpose of assuring the water proofness of polymers and giving a possible interpretation to the mechanism of wettability.
Author

N69-30249# Naval Research Lab., Washington, D.C.
PROCEDURE FOR THE ANALYSIS OF METALS, ALLOYS AND OTHER MATERIALS OF RESEARCH. PART 3: A SPECTROPHOTOMETRIC PROCEDURE FOR THE DETERMINATION OF TRACE AMOUNTS OF COBALT IN FERROUS ALLOYS
O. R. Gates 31 Dec. 1968 12 p refs
(AD-685633; NRL-6857-Pt-3) Avail: CFSTI CSCL 7/4

A procedure is presented for the determination of trace amounts of cobalt in ferrous alloys. The cobalt is extracted as tetraphenylarsonium cobaltothiocyanate in chloroform and is determined spectrophotometrically at wavelength of 620 nm. Cobalt concentrations that range from 0.003 to 0.04% can be determined by this method. The upper concentration limit may be easily increased to cover the analysis of most cobalt-bearing alloys.
Author (TAB)

N69-30254# Massachusetts Inst. of Tech., Cambridge. Dept. of Chemistry.
AVERAGED POTENTIALS AND THE VISCOSITY OF DILUTE POLAR GASES
F. Danon and I. Amdur 1968 23 p refs
(Contract N00014-67-A-0204)
(AD-684892; TR-4(20)) Avail: CFSTI CSCL 7/4

The collision integral for the viscosity of a single dilute polar gas has been obtained for a central pair potential which is an average of the Stockmayer potential over all orientation of the dipoles. Comparison is made between the canonical average potential and the free energy average potential up to a second order approximation. The collision integrals from the two types of average potential and the average, over all orientations, of the collision integrals calculated directly from the Stockmayer potential on the basis of the fixed orientation approximation, are also compared. It is found that both average potentials lead to collision integrals that differ significantly from those based on the more reasonable model of fixed orientations during collisions. However, the collision integrals from the free energy average potential show better agreement than those obtained from the canonical average potential. A similar trend is observed with respect to the second virial coefficients of several polar gases.
Author (TAB)

N69-30262# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE PRODUCTION AND THE PHYSICOCHEMICAL PROPERTIES OF NIOBIUM SULFIDE
V. Kh. Oganesyan et al Jul. 1968 10 p refs Transl. into ENGLISH from Zh. Armyansk. Khim. (USSR), v. 19, no. 3, 1966 p 161–166
(AD-685142; FTD-HT-23-330-68) Avail: CFSTI CSCL 7/2

Synthesis of niobium sulfide (Nb_2S_3) from metallic niobium and niobium oxide and the physicochemical properties of the NbS(1.6) product were investigated. It was found that the optimum conditions for converting metallic niobium or niobium oxide into NbS(1.6) are identical and consist of passing a H_2S stream over these materials at 1000-1300C for 2-4 hours. The content of the free sulfur in the niobium sulfide products varied within the 0.1-0.2% range. It was found that NbS(1.6) is stable toward boiling water and that it decomposes on treatment with concentrated sulfuric acid, concentrated or diluted nitric acid, and hydrogen

peroxide. The NbS(1.6) was found to be stable toward oxygen up to 300C, to oxidize above 300C, and to oxidize to Nb2O3 within 10 minutes at 400C. X-ray examination indicated that in Nb2S(3.2)-Nb2S(3.59, the niobium sulfide has a rhombic lattice. TAB

N69-30287# Wisconsin Univ., Madison.
RADIO FREQUENCY STUDY OF ATOMIC STRUCTURE AND SPECTRA Final Report, May 1965–Sep. 1968
L. W. Anderson Feb. 1969 22 p refs
(Contract DA-31-124-ARO(D)-354)
(AD-684954; AROD-4863.4-P) Avail: CFSTI CSCL 7/4

We have investigated the possibility of using radio-frequency techniques for the study of the spectra and structure of free atomic ions. After consideration of various methods of producing polarized ions and detecting their polarization we concluded that a potentially useful method of producing polarized ions would be the ionization of polarized atoms or by charge exchange collisions of ions with polarized atoms. A possible method of detecting the polarization of polarized ions may be by the use of charge changing collisions between polarized ions and a target of polarized atoms. We have developed and tested a high intensity ion source that is capable of producing polarized ions of Li and Cs. The technical details of this source and its capabilities are described in this report. A target of polarized Cs atoms has been constructed but it has not been adequately tested. Some possible experiments using the polarized ion source and polarized target are discussed in this paper. In addition some experiments on charge exchange collisions between unpolarized ions and unpolarized atoms have been carried out in order to determine various cross sections needed for our work on the detection of radio frequency spectroscopy. Author (TAB)

N69-30295# New South Wales Univ., Kensington (Australia).
A STUDY OF SOME ORGANOPHOSPHORUS COMPLEXES OF BERYLLIUM
Tony Louis Whateley (M.S. Thesis) Jun. 1967 94 p refs
Avail: CFSTI

The document describes an infra-red spectroscopic study of the interaction of beryllium with the organophosphorus extractants tri-*n*-octylphosphine oxide (TOPO) and di-(2-ethylhexyl) phosphoric acid (HDEHP). Shifting and splitting of the nitrate band in $Be(NO_3)_2.2TOPO$ in relation to the large ionic potential of the beryllium ion are explained on the basis of steric hindrance around the small beryllium ion. Similar results are found with aluminium nitrate–TOPO interactions. Beryllium is extracted from aqueous solution by HDEHP initially as a species $Be(DEHP)_2(HDEHP)_2$. A very broad band over the region 1700–800 cm^{-1} indicates the presence of strong, symmetrical or near symmetrical hydrogen bonding in this complex. The species $Be(DEHP)_2$ occurs at higher concentrations of beryllium in the organic phase and bands at 763 and 685 cm^{-1} are shown to be Be-O vibrational modes. Author

N69-30297# Texas Univ., Austin. Dept. of Chemistry.
THE ADSORPTION OF WATER VAPOR ON EVAPORATED IRON FILMS SELECTIVELY CONTAMINATED WITH CHEMISORBED OXYGEN Final Report, 1 Sep. 1964–29 Feb. 1968
Mar. 1969 4 p ref
(Grant DA-ARO(D)-31-124-G572)
(AD-684955; AROD-4804.2-MC) CSCL 7/4

Summaries are given of studies on: the oxidation of aluminum and iron; and the kinetics of interaction of water with both iron and oxidized iron surface; the interaction of alcohols with oxidized iron substrates. TAB

N69-30314# Queens Coll., Flushing, N.Y.
CHARGE TRANSPORT IN ORGANIC CRYSTALS Final Report, 25 Mar. 1966–30 Dec. 1968
Arthur C. Damask Jan. 1969 8 p refs
(Contract DA-ARO(D)-31-124-G813)
(AD-684931; AROD-6432.4-P) Avail: CFSTI CSCL 7/5

A main point of study was of charge transport in high purity anthracene. A contribution of this research was a successful measurement of the Hall effect. Measurements of the third direction are in progress. These results help substantiate the band model of anthracene for, since the carriers are photo-injected their sign is known and, at the present state of knowledge, only the band model can explain an anomalous Hall voltage. Phenanthrene was studied, although it is an isomer of anthracene, it exhibits quite dramatic differences. Also studied was the kinetics of triplet lifetime in phenanthrene. Author (TAB)

N69-30335# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMAL STRUCTURATION OF UNSATURATED POLYESTERS
S. V. Vinogradova et al Jul. 1968 9 p refs Transl. into ENGLISH from Vysokomolekul. Soedin., Ser. B (Moscow), v. 9, no. 1, 1967 p 31–33
(AD-685143; FTD-HT-23-333-68) Avail: CFSTI CSCL 11/9

Kinetics of polycondensation of 2,2-bis(1(2-hydroxyethoxy) phenyl) propane and fumatic acid in the melt at 245-290C under argon was studied by ir spectroscopy (1640 and 1603/cm. bands). At exptl. temps., the polycondensation proceeded like a 1st order reaction. The activation energy of the polycondensation was 28.8 kcal./mole. Author (TAB)

N69-30336# Institute of Technology, Helsinki (Finland). Dept. of Chemistry.
ON THE ELECTROCHEMICAL REDUCTION OF INORGANIC PLATINUM (II) COMPLEXES ON MERCURY
Goran Sundholm (Ph.D. Thesis) [1968] 10 p refs Repr. from Commentationes Physico-Mathematicae, v. 34, no. 7, 1968 p 39–47 refs
Avail: CFSTI

Frumkin's theory for the reduction of anions is not directly applicable to the reduction of platinum (II) complexes. In particular this theory fails to describe the minima obtained at high ionic strength and the structural influence of the reacting particle on its polarographic behaviour. The results obtained are best explained if a direct electrochemical reduction of the complexes at the electrode surface is assumed. Electron transfer to inorganic platinum (II) complexes can occur via ligands forming bridges with the electrode surface and via transfer to the vacant orbital of the central platinum atom. The fact that reduction of platinum (II) complexes at more positive potentials than about -0.8 V_{SCE} is facilitated by the presence of chloride ligands in the complex is interpreted as a catalytic effect of mercury on the reduction process. It is postulated that platinum (II) complexes containing ligands which form insoluble salts with mercury should be more easily reduced than others. The difference in electrochemical behaviour observed between cis- and trans-$Pt(NH_3)_2Cl_2$ is mainly caused by the fact that the former complex is a dipole while the latter has no dipole moment. Author

N69-30343# Case Western Reserve Univ., Cleveland, Ohio.
THE PREPARATION AND PROPERTIES OF ORGANIC DERIVATIVES OF PEROXIDES OF ELEMENTS OTHER THAN CARBON Final Report, 1 Oct. 1965–30 Sep. 1968
Ralph L. Dannley Mar. 1969 8 p refs
(Grant DA-ARO-(D)-31-124-G720)
(AD-684932; AROD-5838-2-C) Avail: CFSTI CSCL 7/2

Bis-Silicon peroxides were synthesized and found to rearrange thermally by a homolytic process. Relative migratory aptitudes were determined for the rearrangement process: phenyl, 1.0; p-tolyl 1.5. Sulfonyl peroxides were found to substitute aromatic nuclei

by an electrophilic process to yield sulfonate esters. This new reaction of aromatic substitution has been quite exhaustively studied as to mechanism and scope. The first hydroperoxides and some new bis-peroxides of germanium have been prepared and their thermal decomposition in solution investigated. Unique tin peroxides prepared from hydrogen peroxide, dialkyltin dimenthoxides and aldehydes or ketones were prepared and their reactions subjected to a preliminary investigation. Author (TAB)

N69-30346# Purdue Univ., Lafayette, Ind. Project Squid Headquarters.
ON BIMOLECULAR CHEMICAL REACTIONS IN IMPERFECT GASES
Michael R. Emptage (Southern Ill. Univ., Carbondale) and John Ross (MIT, Cambridge, Mass.) Mar. 1969 21 p refs
(Contract N00014-67-A-0226; Proj. Squid)
(AD-685605; MIT-49-PU) Avail: CFSTI CSCL 7/4

The initial density dependence of the rate of a bimolecular chemical reaction in a mixture of imperfect gases is derived by the use of a simple physical cluster model. This result is compared with two forms of the activated complex theory; in one (denoted ACT(c)), the rate is assumed proportional to the concentration of the activated complex, and in the other (ACT(a)), proportional to the activity of the activated complex. In certain plausible limits, agreement is obtained between the cluster model and ACT(c). Author (TAB)

N69-30390# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FORMATION OF DIHYDROXYDIFLUORIDE FROM ELEMENTS IN A GLOW DISCHARGE
I. V. Nikitin et al Aug. 1968 9 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSR, Ser. Khim. (Moscow), no. 2, 1968 p 266-269
(AD-685069; FTD-HT-23-467-68) Avail: CFSTI CSCL 7/2

A method is described for obtaining dihydroxydifluoride (O2F2 = dioxygen difluoride) from elements in a glow discharge as the first member of a series of fluorides of oxygen of the general formula OnF2. The reaction of the fluorine with the oxygen took place in a vacuum setup of pyrex glass with a glow discharge. In one experiment there was found F2 42.3%, O2 50.7% as against the computed 50%, 50%. The experiments took place at low temperature, the fluorine-oxygen mixture being cooled as low as 90K. The degree of conversion depends on the specific energy. Ozone was formed in some variations of the experiments. The experimentation confirmed that for the obtaining of dihydroxydifluoride it is sufficient to activate the fluorine. The experiments showed that intense cooling of the walls of the reaction vessel is indispensable. The amount of dihydroxydifluoride obtained is proportional to the volumetric velocity of the flow of the gases. There was established the dependence of the degree of conversion of the fluorine-oxygen mixture on the specific energy. TAB

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N69-29014# Virginia Univ., Charlottesville. Industrial Research and Development Center.
SOME ELEMENTS OF FM RANGE MEASURING: SPECTRAL ANALYSIS Final Report
G. A. McAlpine, J. F. Dammann, J. H. Highfill, and J. C. Isaacs Feb. 1969 278 p refs
(Contract DAAG39-68-C-0014)
(AD-684482; IRDC-3376-III-69u) Avail: CFSTI CSCL 17/9

Three factors, influencing the performance of FM distance measuring systems generally, were considered with respect to their specific effects on the spectrum of the post mixer signal: (1) Two forms of the modulating signal were studied: (a) A periodic, triangular sweep frequency modulating signal, and (b) A random period triangular sweep frequency modulating signal; (2) Nonlinearity in the frequency-to-modulating voltage characteristic was investigated for three different nonlinear characteristics. (3) Target characteristics were studied with an area target model, two different beam patterns and various surface conditions. Each study in general consisted of appropriate mathematical development of a computational model and then presentation and discussion of calculated spectral data, comprising a parametric study of the effect involved. In the random period study two independent approaches were pursued and results were found to be in essential agreement. Author (TAB)

N69-29034 Stanford Univ., Calif.
PSEUDORANDOM FREQUENCY MODULATION IN RANGE-DOPPLER RADAR
Arpad Alex Barna (Ph.D. Thesis) 1968 76 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 69-191

In many radar systems, efficient use of transmitter power requires the transmission of a constant-amplitude signal for a substantial fraction of time; for monotonic transmission, however, the range resolution is restricted by the length of the transmitted pulse. Linear frequency modulation removes this constraint for targets with negligible, or known, radial velocities; it is not suitable, however, for simultaneous observation of range and radial velocity (Doppler shift). A class of waveforms suitable for simultaneous measurement of range and Doppler shift is described. These waveforms are characterized by a uniform distribution in frequency and by a random rate of frequency change. Uniform frequency distribution is attained by a uniform spacing of frequencies with each frequency present for an identical length of time. A random rate of frequency change is attained by sequencing the frequencies by a pseudorandom number generator. Dissert. Abstr.

N69-29045 California Inst. of Tech., Pasadena.
FEEDBACK COMMUNICATION USING ORTHOGONAL SIGNALS
Stephen Stuart Lavenberg (Ph.D. Thesis) 1968 80 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 69-522

Research was done on block coding for a feedback communication system in which the forward and feedback channels are independently disturbed by additive white Gaussian noise and average power constrained. Two coding schemes are proposed in which the messages to be coded for transmission over the forward channel are realized as a set of orthogonal waveforms. A finite number of forward and feedback transmissions (iterations) per message is made. Information received over the feedback channel is used to modify the waveform transmitted on successive forward iterations in such a way that the expected value of forward signal energy is zero on all iterations after the first. Similarly, information is sent over the feedback channel in such a way that the expected value of feedback signal energy is also zero on all iterations after the first. Dissert. Abstr.

N69-29181 Stanford Univ., Calif.
LUNAR RADAR SCATTERING AT 6 AND 12 METER WAVELENGTHS
Alan Alexander Burns, Jr. (Ph.D. Thesis) 1968 137 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 69-203

Radar echoes of the moon at wavelengths of 6 and 12 m are analyzed to obtain more knowledge about the scattering properties of the lunar surface. The delay spectra, or reflected power vs range curves, are measured at both wavelengths. At 12 m, the ratio of the expected linearly polarized component to the depolarized component is also measured. The range resolution used for these observations was about 20 μs, making the results directly comparable to those from other observations at much shorter wavelengths. This resolution is about an order of magnitude better than that previously obtained at the long wavelengths. The influences of the ionosphere on this signal are studied, and the Faraday effect, which is the most important here, is shown to modulate the echoes sinusoidally. It is demonstrated that the total Faraday rotation is proportional to the modulation frequency, and that the frequency can be measured directly from the echoes.
Dissert. Abstr.

N69-29230*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
ANALYTIC FUNCTION MODELS OF NOISE AND MODULATION
John H. Painter, Someshwar C. Gupta, (Southern Methodist Univ.), and Jon W. Bayless (Southern Methodist Univ.) Washington Jun. 1969 32 p refs
(NASA-TR-R-314) Avail: CFSTI CSCL 17B

The theory of complex analytic time functions are applied to a representation of stochastic and deterministic time processes. By using analytic notation, noise and modulated signals are represented in the same manner. A mathematically rigorous method of transition from real to analytic processes is given. By use of the theory of distributions, the rotating vector, or phasor, method is generalized to arbitrary functions and stochastic processes. The advantages of analytic time function notation are exploited to derive correlation and spectral functions for both signal and noise processes. The polar and quadrature forms for band pass processes are derived.
Author

N69-29255 Houston Univ., Tex.
SIGNAL DESIGN FOR A CODED COMMUNICATION SYSTEM
Stephen Riter (Ph.D. Thesis) 1968 172 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-782

The general problem of the choice of modulation and multiplexing techniques is first examined. It is shown that a frequency division multiplexed system is in a sense optimum for this signal set. It is also shown that two good modulation techniques are amplitude modulation and phase modulation, but that it is not possible to categorically choose one over the other. The effect of a noisy phase reference and noisy timing signals on the performance of the phase shift keyed data signals is analyzed. The optimum detector for receiving such signals with a noisy phase reference is derived. The performances of two practical detectors, the squaring loop and the Costas loop, are analyzed and compared with the optimum detector. It is shown that for all practical purposes the Costas loop closely approaches the performance of the optimum detector for all signal to noise ratios. It is also shown that the effects of timing errors are relatively insignificant when compared with phase reference errors.
Dissert. Abstr.

N69-29263*# Techtran Corp., Glen Burnie, Md.
SATELLITE READ OFF, PRELIMINARY PROJECT. PROJECT FOR COOPERATION BETWEEN FFI AND CMI [SATELITT-UTLESNING, FORPROSJEKT SAMARBEIDSPROSJEKT MELLOM FFI OG CMI]
Jan Stroemme Washington NASA Jun. 1969 12 p Transl. into ENGLISH from Chr. Michelsens Institutt, Avd. for Naturvidenskap og Teknikk report CMI-66.31-8/JS
(Contract NASw-1695)
(NASA-TT-F-12267) Avail: CFSTI CSCL 17B

The establishment of two-way radio contact between a telemetry station and an anchored oceanographic–meteorological buoy by satellite link is evaluated both technically and economically. Designs for buoy and radio equipment are suggested, and the information to be transmitted is analyzed.
Author

N69-29288 Stanford Univ., Calif.
LOCATING REFRACTIVE INDEX VARIATIONS WITH BISTATIC-RADAR
Edwin Carl Thiede (Ph.D. Thesis) 1968 117 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-303

A randomly varying medium causes both amplitude and phase fluctuations on a wave propagating through it. The time variations of the medium are shown to provide a mechanism for viewing isolated regions along the propagation path. A general technique for locating these fluctuation regions is introduced. The distribution of refractive index variations versus distance along the propagation path are measured. The technique is mechanized for space applications by using a transmitter and receiver both in the spacecraft and on the ground. The spacecraft receiver and transmitter are connected in a manner which enables the integrated uplink phase modulation to be relayed back down to the ground receiver on a slightly different carrier frequency. This bistatic-radar technique provides two copies of the modulation waveform from each source region. The two copies are separated with a time delay which corresponds to the range of the source. Autocorrelating the ground receiver signal gives a positive correlation only when the time delay of each source region is matched.
Dissert. Abstr.

N69-29303 Washington Univ., Seattle.
THE CHANNEL CAPACITY OF RANDOM TIME-VARYING LINEAR COMMUNICATION CHANNELS
Meletios Geokezas (Ph.D. Thesis) 1968 87 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-1171

The channel capacity of a random, time-varying, linear communication channel is considered. Specifically, four communication channels of interest are discussed in terms of their input-output characteristics in the time and frequency domains. Two types of channel capacities are considered: One when the channel state is not known a priori; and the other when the channel state is known exactly a priori. The channel capacities of the specified communication channels are evaluated using the Pontryagin's maximum principle, a calculus of variations technique, and a maximization computer technique. Another important result is the optimum power spectral density of the transmitted signal.
Dissert. Abstr.

N69-29339 California Inst. of Tech., Pasadena.
THE RESOLUTION OF THE THERMODYNAMIC PARADOX AND THE THEORY OF GUIDED WAVE PROPAGATION IN ANISOTROPIC MEDIA
Adolph Vincent Mrstik (Ph.D. Thesis) 1968 158 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-526

The resolution of the so-called thermodynamic paradox is presented in this paper. It is shown, in direct contradiction to the results of several previously published papers, that the cutoff modes can carry power in a waveguide containing ferrite. The errors in all previous "proofs" which purport to show that the cutoff modes cannot carry power are uncovered. The boundary value problem underlying the paradox is studied in detail; it is shown that, although the solution is somewhat complicated, there is nothing paradoxical about it. The general problem of electromagnetic wave propagation through rectangular guides filled inhomogeneously in cross-section with transversely magnetized ferrite is also studied. The problem is split into TE and TM parts and scalarized. Application of the standard waveguide techniques reduces the TM part to the well-known self-adjoint Sturm Liouville eigenvalue equation. Dissert. Abstr.

N69-29445# Princeton Univ., N.J. Dept. of Electrical Engineering.
A LINGUISTIC MODEL FOR WAVEFORM ANALYSIS
Theodosios Pavlidis Mar. 1969 22 p refs
(Contract DAHC04-69-C-0035)
(AD-684360; AROD-8244-1-4) Avail: CFSTI CSCL 20/14

Many important pattern recognition problems deal with waveform analysis, e.g., electrocardiograms, engine noise signatures, etc. Spectral analysis is usually not helpful in such cases. A method is described by which a time function can be represented as a concatenation of simpler functions instead of a sum as is the case with spectral analysis. This representation emphasizes features of short duration which tend to be obscured in the spectral analysis. Furthermore, one can use the results of the analysis to represent the waveforms as strings of symbols. A procedure for imperfect matching of such strings is given and the problem of detecting common substrings which characterize the various classes is discussed. Author (TAB)

N69-29602# Cambridge Acoustical Associates, Inc., Mass.
DESIGN PARAMETERS OF FREE-FLOODING CYLINDRICAL TRANSDUCERS
Miguel C. Junger Feb. 1969 25 p refs
(Contract N00014-69-C-0086)
(AD-685278; CAA-U-308-210) Avail: CFSTI CSCL 17/1

The free-flooding cylindrical transducer devoid of pressure-release material combines resistance to hydrostatic pressure with design flexibility resulting from the existence of resonances primarily controlled by two independent dimensions: the radius, which controls the structural (ring) resonance, and the axial length which determines the acoustic (squirter) resonance. Values of radiation impedance generated for a squirter of vanishing wall thickness from an integral equation formulation of the free-flooding cylinder of finite length, were used to compute curves of dimensionless natural frequency vs. squirter aspect ratio (ratio of length to diameter) and of motional conductance vs. dimensionless frequency. It is concluded that (a) squirters of small aspect ratio are undesirable, (b) squirters of medium and large aspect ratio can combine wide bandwidths with substantial conductance levels; (c) squirters with large aspect ratios should have in vacuo natural frequencies substantially lower than generally obtained with transducer materials; the natural frequency can be lowered to the desired value by attaching axially oriented inertia wedges to the squirter; (d) near-coincidence of the acoustical (squirter) resonance with the structural (ring) resonance can produce an exceptionally wide bandwidth for squirters of large aspect ratio provided the slopes of the transducer and radiation reactance mutually compensate near the in vacuo natural frequency, thus producing a frequency range of near-resonant condition. An equation is derived which the transducer parameters must satisfy to produce this condition. Author (TAB)

N69-29640 Michigan State Univ., East Lansing. Div. of Engineering Research.
MODIFICATION OF RADAR CROSS SECTION OF METALLIC OBJECTS AND INVESTIGATION OF ANTENNAS Final Report, 1 Jan. 1966–31 Dec. 1968
K. M. Chen Feb. 1969 20 p refs
(Contract AF 19(628)-5732)
(AD-685467; AFCRL-69-0102) Avail: CFSTI CSCL 17/9

The subjects investigated were (1) the modification of the radar cross sections of metallic objects by the impedance loading method and the compensation method and (2) the impedence loaded linear antennas and the back-fire antennas. Author (TAB)

N69-29722# Naval Research Lab., Washington, D.C.
OVERWATER LINE-OF-SIGHT FADE MEASUREMENTS AT 37 GHz Interim Report
J. A. Vignali, K. M. Decker, and R. C. Dodson Dec. 1968 43 p refs
(AD-684071; NRL-6774) Avail: CFSTI CSCL 20/14

The short-term fading on an overwater line-of-sight path at 37 GHz was characterized. Fade depths of 8 db were typical, although fade depths from 3 db to 14 db were observed (measured between the median and the 98% value of the distribution). The fading generally displayed a fast and a slow component with typical average values of about 0.5 fade per second and 1.5 fades per minute. The corresponding average fade durations were 1 sec and 20 sec, respectively. The importance of the specular reflection from the water surface was clearly evident in the results. The typical value of the specular reflection coefficient was about 0.7, but the extreme values varied from almost 0 to 1. The reflection coefficient of the diffusely scattered component showed less variation and was typically about 0.25. The use of a 15-db fade margin would be sufficient to maintain the received signal above a desired threshold for at least 98% of the time for every sample of data examined. For effective time diversity operation, a time delay of about 10 sec would likewise be sufficient for every sample examined. Author (TAB)

N69-29755# Parke Mathematical Labs., Inc., Carlisle, Mass.
MATHEMATICAL RESEARCH ON CODING THEORY Final Report, Dec. 1966–Dec. 1968
Dec. 1968 61 p refs
(Contract F19628-67-C-0030)
(AD-685206; AFCRL-69-0030) Avail: CFSTI CSCL 9/4

A brief summary of the research performed under the contract. New constructions of synchronizable codes with their synchronization delays are presented. A list is given of relatively large cyclic codes. Author (TAB)

N69-29757*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
136 MHz GROUND STATION CALIBRATION USING CELESTIAL NOISE SOURCES
Ralph E. Taylor Apr. 1969 40 p refs Submitted for publication
(NASA-TM-X-63571; X-523-69-135) Avail: CFSTI CSCL 17B

A calibration technique, using radio stars, is developed that provides an absolute determination of the threshold sensitivity of a 136 MHz satellite ground station receiving system. Sensitivity is expressed in terms of the system constants and radio star flux density. A station's day-to-day sensitivity can thus be monitored with high accuracy. Preliminary field test results indicate that 1 dB can be achieved. The gain of a large steerable antenna, such as an 85 ft.-diameter parabolic dish, can also be determined within 1 dB using radio stars. A calibrated 136 MHz injected-signal source is required. The utilization of celestial hot-spot sources, including the galactic center, is suggested as standard noise sources for evaluating bit error probability performance in a 136 MHz PCM telemetry system. Author

N69-29784*# Hughes Aircraft Co., Culver City, Calif. Antenna Dept., Aerospace Group.
HIGH-GAIN SELF-STEERING MICROWAVE REPEATER, VOLUME 1 Final Engineering Report, Jan. 1966–Apr. 1969
R. A. Birgenheir and W. H. Kummer Apr. 1969 124 p refs
(Contract NAS5-10101)
(NASA-CR-101579; P67-303) Avail: CSFTI CSCL 17B

A study of advanced self-steering techniques that could be applied to satellite communication links was conducted. An engineering model of a high-gain self-steering microwave transponder and associated attitude readout circuitry was designed, fabricated, and tested. In addition, the application of a specific type of self-steering repeater to a data relay satellite system was explored, and a possible configuration for such a system was evolved. A unique module-coupling technique was invented for the elimination of beam-pointing errors that arise when a single channel is used for duplex operation. The various types of self-steering arrays are discussed, and brief descriptions are given of breadboard models of two different arrays and of the general design considerations for the engineering model and attitude readout. The engineering model with the results of test measurements made of the antenna system are described in detail. Specific applications of a self-steering array are also discussed. Author

N69-29779# Naval Research Lab., Washington, D.C. Radar Div.
AMPLITUDE SCINTILLATION AT RANDLE CLIFF DERIVED FROM ATS-1 TRANSMISSIONS
John M. Goodman and John E. Blundy 17 Mar. 1969 63 p refs
(AD-685632; NRL-6829) Avail: CFSTI CSCL 17/2.1

An amplitude scintillation analysis of vhf radiowave transmissions from the geostationary satellite ATS-1 has been conducted. It has been found that the amplitude scintillation activity is generally less intense during the day than during nocturnal hours. In fact, the present 1967 summertime data indicate that the full scintillation condition is 50% more likely to occur during nighttime than during the day over Randle Cliff. The data have been compared with the Fort Belvoir ionosonde data, and, as expected, point-to-point correlations are inconclusive. Nevertheless, the trend of the data compares more favorably with the diurnal pattern of sporadic E over midlatitudes than the spread F condition. Author (TAB)

N69-29782*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A QUALITY CONTROL MONITORING SYSTEM FOR SATELLITE TELEMETRY DATA INFORMATION SYSTEMS
Thomas J. Karras May 1969 24 p refs Submitted for publication
(NASA-TM-X-63577; X-563-69-212) Avail: CFSTI CSCL 17B

A quality control monitoring system for a satellite telemetry data information system is described which could provide the necessary in-depth monitoring, evaluation, and analysis capability for determining short and long term information systems performance characteristics. Station environmental problems, seasonal changes, and signal-to-noise characteristics of recorded passes over time of day, time of year as a function of satellite range, data recovery, data quality, and received power could be observed with man–machine analysis in a short period of time. The station performance for a satellite recording could be viewed over any selectable range of time intervals. Time of day distribution analysis of processed data could be performed for many recorded passes to observe station–satellite environmental time-dependent problems. The quality control monitoring system is currently under investigation using an existing R&D data control monitoring display system located in the IPD. If results prove promising then the IPD will have a quick-reaction type monitoring, evaluation, and man–machine analysis capability for a satellite telemetry data information system. Author

N69-29799# Joint Publications Research Service, Washington, D.C.
COMMUNICATIONS MEDIA IN CONTROL SYSTEMS
K. A. Smirnov 4 Jun. 1969 46 p refs Transl. into ENGLISH of the book "Sredstva Svyazi v Upravlyayushchikh Sistemakh" Moscow, Znaniye, 1969 p 1–46
(JPRS-48160) Avail: CFSTI

A two part overview of the optimum use of computers in the control of economic systems by the use of data links is presented. The first part, directed toward specialists in classical communications systems (telegraph, telephone, etc.), details the requirements on information exchange media in economic systems. A second part, oriented toward administrative specialists with little or no background in current advances in communications technology, presents basic concepts and hardware descriptions of data transmission and processing. Emphasis is placed on random access, real time control of individual industrial operations with some proposals and consideration of higher level control, i.e., national economic control systems. K.R.G.

N69-29800# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE DEVIATIONS OF MARINE RADARS
S. M. Latinskiy 19 Nov. 1968 133 p refs Transl. into ENGLISH of the Book "Devyatsiya Sudovykh Radioiokatsionnykh Stantsiy" Leningrad, Izd-Vo Sudostroyeniye, 1966 p 1—159
(AD-685415; FTD-HT-23-1671-67) Avail: CFSTI CSCL 17/9

The influence of superstructure, masts and other obstacles on the parameters of shipboard radars is examined. Special attention is devoted to the effect of shipboard obstructions on errors in direction-finding. The fundamentals of the theory of radar deviations are presented, and errors in the radar measurement of elevation angle attributable to the influence of the earths surface are considered. Author (TAB)

N69-29860# Hughes Aircraft Co., Culver City, Calif. Aerospace Group.
STATISTICAL INVESTIGATION OF THE EFFECT OF THE TROPOSPHERE ON MILLIMETER-WAVELENGTH RADIATION AND COHERENCE Final Report, 15 Nov. 1967–14 Feb. 1969
G. O. Young and G. Hrycenko Feb. 1969 109 p refs
(Contract F19628-68-C-0118)
(AD-685246; AFCRL-69-0047; HAC-P68-281) Avail: CFSTI CSCL 20/14

The coherence properties of radio propagation through the troposphere at millimeter-wave frequencies were statistically analyzed to obtain a description of the medium. Experimental data, obtained at a 39-GHz frequency over an 18-mile radio link, included analog and digital recordings of demodulated r-f signals received by two antennas that were separated vertically. A very thorough statistical analysis of these data was made. Moments and probability distributions of the received signal amplitude were determined by experimentation. The fit of these distributions to theoretical curves was measured and found to be good. Other analyses that were performed included the computation of autocorrelation functions and corresponding spectral densities and cross-correlation functions and cross-spectral densities in both space-time and frequency. The coherence and other statistical properties of the received signals were measured in space as well as in time, and the effect of the medium on these properties was analyzed. The most important result was the significant decorrelation observed in the vertical plane between the amplitude fluctuations of the signal outputs of the two antennas, particularly under windy weather conditions. Author (TAB)

N69-29861# Advisory Group for Aerospace Research and Development, Paris (France).
SCINTILLATION OF SYNCHRONOUS SATELLITE TRANSMISSIONS AT 136 MHz
Jules Aarons (AFCRL) Nov. 1968 20 p
(AGARD-586) Avail: CFSTI

With the aim of studying techniques for using the upper portion of the VHF band for communications and navigation, a series of experimental synchronous satellites was launched. This preliminary survey aimed to add data on scintillations of signals at 136 MHz and to standardize methods of reducing results from a number of European observing stations. Initial qualitative results show that invariant latitude and conjugate point effects may play important roles in the scintillation process. Author

N69-29931# Istituto Superiore delle Poste e delle Telecomunicazioni, Rome (Italy).
DESIGN AND PERFORMANCE OF A MODEL OF A FREQUENCY SELECTIVE ECHO SUPPRESSOR [REALIZZAZIONE DI UN MODELLO DI SOPPRESSORE D'ECO SELETTIVO IN FREQUENZA E CARATTERIZZAZIONE PRELIMINARE DELLE SUE PRESTAZIONI]
Luigi Giacomelli and Aldo Roveri Fondazione U. Bordoni 7 Sep. 1968 28 p In ITALIAN
Avail: CFSTI

A frequency selective echo suppressor for telephonic communication is described. The principles employed are discussed and complete design is given in the form of circuit diagrams. The results of performance tests are also discussed. ESRO

N69-29947# Naval Research Lab., Washington, D.C. Radar Div.
NONCOHERENT DETECTION ON NONFLUCTUATING TARGETS IN CONTAMINATED-NORMAL CLUTTER Interim Report
G. V. Trunk 21 Mar. 1968 14 p refs
(AD-685634; NRL-6858) Avail: CFSTI CSCL 17/9

Measurements of sea clutter using high-resolution radar indicate that clutter cross-section returns do not follow a Rayleigh distribution. In the report, a contaminated-normal distribution is proposed and found to be a good description of some of the clutter data taken by the high-resolution radar. The report then develops the theory necessary for detecting constant signals in contaminated-normal clutter when N pulses are summed noncoherently. Curves are presented for the threshold values, normalized to the median clutter voltage, versus the probability of false alarm for N = 1, 3, 10, and 30 pulses. Finally, probability of detection curves are presented for the previous Ns and for false alarm probabilities ranging from 10.01 to 10 to the minus 9th power. Author (TAB)

N69-29948# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPLICATION OF A SENSITIVE TELEVISION SYSTEM TO OBSERVATION OF ARTIFICIAL EARTH SATELLITES
E. S. Agapov et al 4 Dec. 1964 8 p Transl. into ENGLISH from Dokl. Mezhdunarodnyi Kong. po Astronavtike (Warsaw), v. 2, 1965 p 341–343 Presented at 15th Intern. Astronautical Congr., Warsaw, 1964
(AD-685005; FTD-HT-23-1115-68) Avail: CFSTI CSCL 17/8

The application to satellite technology of the contemporary television system increases the sensitivity of observation by about 100 times, compared to ordinary photography. Once such a system is established, a satellite can be tracked and its position recorded. The television camera is described as having an objective lens with a diameter of 80 mm; at the photocathode the image taken appears with a scale of 17 per 1 mm, which is sufficient for application to regulation and control of satellites. TAB

N69-29984# Fondazione Ugo Bordoni, Rome (Italy).
MODULATION SYSTEMS FOR DIGITAL DATA TRANSMISSION ON CHANNELS WITH LIMITED BANDWIDTH [SISTEMI DI MODULAZIONE PER TRASMISSIONE DI INFORMAZIONI DIGITALI SU CANALI LIMITATI IN BANDA]
Giuseppe M. Pascetti 21 Sep. 1967 102 p refs In ITALIAN
Avail: CFSTI

Different modulation systems for digital data transmission are examined. Systems without any data correlation but with amplitude, frequency and phase modulation are first discussed. Systems having data correlation and the different coding methods are then analyzed. Finally a general description of different digital data transmission systems is given. ESRO

N69-29988*# Planning Research Corp., Los Angeles, Calif.
ONBOARD CHECKOUT AND DATA MANAGEMENT SYSTEM: HARDWARE DEFINITION
F. C. Fischer, W. C. Graham, K. King, L. S. Michels, L. Mittman et al 21 Sep. 1967 187 p refs
(Contract NASS-20367)
(NASA-CR-98468); PRC-D-1336) Avail: CFSTI CSCL 17B

Results are described of a design study to define the requirements for and to do the conceptual design of an Onboard Checkout and Data Management System (OCDMS) for use in Apollo Applications Program (AAP). The operating purpose of the OCDMS is to provide data management and checkout support for the AAP experiments. The major location considered was the lunar module vehicle. A dynamic adaptive data management capability was postulated for the OCDMS; it provided the capability to monitor the operation of experiments, analyze the adequacy of the experimental data, and modify the operations as required. It was primarily a spaceborne function. The basic operational and design objectives for the overall system are described, along with the operational characteristics, both from an operator's standpoint and in relation to the types of tasks the system will perform. A detailed discussion is presented on the five major elements of the system, the reliability design requirements, and the means by which the system could be extended to assist in onboard Saturn checkout. A survey was made of spaceborne computers, instrumentation, and calibration considerations in relation to the OCDMS. G.P.

N69-30050# Istituto Superiore delle Poste e delle Telecomunicazioni, Rome (Italy).
DETERMINATION OF COMPRESSION LAWS TO BE REALIZED BY NUMERICAL COMPRESSION SUITABLE FOR A PCM SYSTEM WITH A REQUIRED SIGNAL-TO-NOISE RATIO [DETERMINAZIONE IN BASE AL RAPPORTO SEGNALE RUMORE RICHIESTO IN UN SISTEMA PCM DI ADATTE 'LEGGI DI COMPRESSIONE' REALIZZABILI MEDIANTE 'COMPRESSIONE NUMERICA']
Giuseppe M. Pascetti (Fondazione U. Bordoni) Fondazione U. Bordoni 9 Jul. 1968 26 p In ITALIAN
Avail: CFSTI

A special group of compression laws particularly suitable for numerical compression is presented. A synthesis is described by which it is possible to determine the parameters related to a particular compression law, having in mind the minimum value required for the signal-to-noise ratio. ESRO

N69-30068*# ADCOM, Inc., Cambridge, Mass.
DEVELOPMENT OF ADVANCED DIGITAL TECHNIQUES FOR DATA ACQUISITION PROCESSING AND COMMUNICATION Interim Scientific Report

S. M. Sussman, E. P. Greene, and R. Zaorski. 15 Mar. 1969 58 p refs
(Contract NAS12-554)
(NASA-CR-86158; G-98IS) Avail: CFSTI

This report covers work performed in the following areas: (1) the development of fidelity criteria for automatic evaluation of image quality; (2) the analysis of various methods for encoding the significant sample point timing information in one-dimensional data compression algorithms; and (3) the development of two-dimensional data compression algorithms. Two approaches are described in terms of motivation for their selection and computer program implementation. One approach is based on the statistics of areas consisting of contiguous picture elements of the same intensity. The second approach derives the statistics of error-run-lengths along a scan line. Two-dimensional data compression algorithms are described for taking advantage of image correlation in both horizontal and the vertical direction. Two approaches are discussed in which the picture is divided into squares comprising a small number of picture elements. In one case the image is represented by a set of four edge patterns. In the other case a finite set of normalized intensity patterns is employed provided the correlation with the actual pattern over the square is sufficiently high.
Author

N69-30092# Environmental Science Services Administration, Boulder, Colo. Research Labs.
CALCULATED MODE CONVERSION COEFFICIENTS FOR A GRADED HEIGHT CHANGE IN THE EARTH-IONOSPHERE WAVEGUIDE AT VLF
Kenneth P. Spies and James R. Wait. May 1968 27 p refs
(Contract N00173-3-006354)
(ERL-77-OD-1) Avail: SOD $0.25

Using a previous formulation, calculations are carried out for the modal conversion coefficients which arise in VLF waveguide propagation in an idealized transition between day and night. A sharply bounded isotropic ionosphere is employed and the transition region is approximated by a finite number of uniform sections of equal length. The relevance of the results to experimental data is discussed briefly. It is indicated that the observed conversion between modes of order one and two are consistent with the calculated results if the transition length for sunrise is of the order of 500 km.
Author

N69-30136# Japan Broadcasting Corp., Tokyo. Technical Research Labs.
INFLUENCES OF TERRAIN IRREGULARITIES AND ENVIRONMENTAL CLUTTER SURROUNDINGS ON THE PROPAGATION OF BROADCASTING WAVES IN THE UHF AND VHF BANDS
Akira Kinase. Mar. 1969 65 p refs /its Tech. Monograph No. 14
Copyright. Avail: CFSTI

This paper gives the results of an analysis of the effects of irregular terrain and environmental clutter surroundings on ground-wave propagation at frequencies in the UHF and VHF bands, at such distances that variations in atmospheric refractive index are usually of little significance. The urban propagation characteristics of broadcasting waves at 700 MHz band are considered. The analysis is based on theoretical and experimental investigations, and the prediction methods of field strengths are presented for a variety of terrain and environmental conditions. New methods of predicting the urban clutter effects with the introduction of a new parameter Γ, and the screening effects of a building are discussed to meet the practical engineering purposes. Illustrative examples are worked out for each item of the subject.
Author

N69-30169# Naval Research Lab., Washington, D.C.
REPORT OF NRL PROGRESS
May 1969 44 p refs
(NAVSO-P-3012) Avail: CFSTI

Significant technical progress on individual projects and problems of the research and development program at the Naval Research Laboratory is summarized briefly. The work included: a FORTRAN program for reduction of acoustic impedance data; vertical distribution of water vapor over Washington, D.C., during 1966 and 1967; inhibition of iron catalyzed neopentyl poloyol ester thermal degradation through passivation of the active metal surface by tricresyl phosphate; surface chemistry of plastics reinforced by strong fibers; adsorption of carbon-14-labeled stearic acid on soda lime glass; antenna applied research; microwave photodiodes; metallurgy; measurements of elastic and inelastic neutron scattering by the use of a ring geometry method; lanthanum fluoride electrode response in water and in sodium chloride; and fracture mechanics as related to the Neuber stress concentration factor and plastic particle. A paper is presented on the NRL four frequency radar system which is used to measure the characteristics of the energy backscattered from targets and terrain. Published reports, scientific papers, and patents for this reporting period are also summarized.
B.P.

N69-30170# Texas Univ., Austin. Electronics Research Center.
RECOGNITION OF SPOKEN DIGITS UTILIZING SEQUENTIAL PATTERNS Interim Report
Robert C. Ohlendorf and C. L. Coates. Nov. 1968 88 p refs
(Grants AF-AFOSR-67-766A; NSF GK-1146)
(AD-685128; JSEP-TR-57; AFOSR-68-2468) Avail: CFSTI CSCL 5/7

In linguistics each spoken word can be broken down into a series of phonemes or units of sound. Ideally each phoneme can be characterized by the fundamental frequency and the position of the formants in the speech spectrum. This is not possible in the practical case because each phoneme is affected by the phoneme before and after it. Furthermore, the fundamental frequency and formant positions are different for different people. However, by using the fundamental frequency and the formant resonances to characterize each phoneme to some degree, and then using sequences of these characterizations, recognition can be achieved. The characterizations used in this study were determined by comparing signal intensities in different frequency bands. The voice spectrum was broken into 22 bands using a bandpass filter set with 1/3 octave spacing of the center frequencies. The lowest center frequency was 100 hertz and the highest 12500 hertz. Each of the 22 analog signals were then rectified, smoothed, multiplexed, and digitized. The digital form of the data was that actually used to determine the sequential patterns of signal intensity concentrations used for recognition. Using a data base of 25 speakers, 14 female and 11 male, a recognition rate of 99.5% with a misrecognition rate of 8.2% was achieved.
Author (TAB)

N69-30173# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SIGNAL TO NOISE RATIOS FOR TELEVISION TRANSMISSION
Lewis D. Collins. 14 Mar. 1969 45 p refs
(Contract AF 19(628)-5167)
(AD-685697; TN-1969-12; ESD-TR-68-50) Avail: CFSTI CSCL 17/2

The note is concerned with the effects of random noise interference in television transmission systems. Such systems are finding increasing application in surveillance and telefactor systems. Numerous results which have been scattered throughout the literature are collected and unified. Three topics are covered: (1) The calculation of the video signal-to-noise ratio for the commonly used television transmission systems (amplitude and frequency

modulation); (2) A summary of the signal-to-noise ratio definitions (including noise weighting standards) currently in use for video transmission and conversion between these definitions; and (3) A brief discussion of the subjective evaluation of television picture quality in terms of signal-to-noise ratio. Author (TAB)

N69-30184# Fondazione Ugo Bordoni, Rome (Italy).
PRELIMINARY STUDY OF WAVEGUIDES FOR LONG DISTANCE TELECOMMUNICATIONS [STUDIO PRELIMINARE SULLE GUIDE D'ONDA PER TELECOMUNICAZIONI A GRANDE DISTANZA]
Gian Carlo Corazza and Tullio Corzani (Trieste Univ.) 13 Jul. 1968 239 p In ITALIAN
Avail: CFSTI

The problem of using a waveguide for long distance telecommunications is analyzed. Different types of circular waveguides are described and their advantages and disadvantages are examined. The optimum frequency range for low attenuation is investigated and the problems of bends and overmoding are analyzed. The plain metallic circular waveguide is very difficult to set and needs the insertion of waveguide filters. The helical waveguide, on the contrary, is the best solution from a theoretical point of view, but is uneconomical. Waveguides coated with a dielectric material have quite good electromagnetic characteristics and are also quite economical. The corrugated waveguide is very good for bends, even with a small radius of curvature. Different problems are analyzed and solutions are proposed. Cost estimates are also given. ESRO

N69-30198# Naval Research Lab., Washington, D.C.
LONDONDERRY-CHELTENHAM DATA MODEM TRIALS OF 1968: TEST PLAN, INSTRUMENTATION, AND LOGISTIC ASPECTS Interim Report
F. C. Kahler, M. Y. McGown, and W. M. Jewett Dec. 1968 31 p refs
(AD-685589; NRL-ML-1963) Avail: CFSTI CSCL 17/2

An evaluation was made to compare the performance of a frequency-shift-keyed (FSK) type modem with differentially coherent phase-shift-keyed (DPSK) type modems operating over an HF radio path. Tests were conducted during the period 10 June 1968 to 3 August 1968 with transmission from the U.S. Naval Communication Station, Londonderry, Northern Ireland to the U.S. Naval Communication Station, Cheltenham, Maryland. The RF communication system was of the single sideband type. The data rate was 2400 bits/second. The FSK modem was the duobinary, 16 channel AN/FYC-9. The three DPSK modems that were tested were the 16 channel AN/USC-10(V), the 12 channel MD-671(SRC), and the Model 35. The Model 35 was a digital implementation of the AN/USC-10(V). Bit error rate data were collected on each modem over one minute periods. Each one minute period was associated with a three minute period during which the propagation path was characterized. Analysis of this data has not been completed. The report covers the test plan and instrumentation that was used. Author (TAB)

N69-30234*# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
INITIAL OBSERVATIONS OF VLF ELECTRIC AND MAGNETIC FIELDS WITH THE INJUN 5 SATELLITE
Donald A. Gurnett, G. William Pfeiffer, Roger R. Anderson, Stephen R. Mosier, and David P. Cauffman Apr. 1969 63 p refs
(Contracts NAS5-10625; NAS1-8141; NAS1-8144(f); NAS1-8150(f); Grants NGR-16-001-043 at al NGT-16-001-004; Contract Nonr-1509(06))
(NASA-CR-101677; Rept-69-19) Avail: CFSTI CSCL 17B

The Injun 5 satellite carried a very low frequency (VLF) electric and magnetic field experiment covering the frequency range from dc to 105 kHz for electric fields and 30 Hz to kHz for magnetic fields. This paper describes the VLF experiment and presents initial results of immediate interest. Most of the common types of VLF electromagnetic noise, electron and proton whistlers, chorus, ELF hiss, VLF hiss, and periodic emissions, have been observed simultaneously with both the electric and magnetic antennas. New phenomena observed include (1) spin modulation of lower hybrid resonance noise, (2) multiple frequency noise bands possibly related to lower hybrid resonance noise, (3) a narrow bandwidth electric field enhancement near the two-ion cutoff frequency, and (4) noise bands associated with harmonics of the proton gyrofrequency. Author

N69-30246*# New Mexico State Univ., Las Cruces. Engineering Experiment Station.
ADVANCED STUDY OF VIDEO SIGNAL PROCESSING IN LOW SIGNAL TO NOISE ENVIRONMENTS Semiennual Progress Report, 1967-1968
Frank Carden and Louis Corl May 1969 54 p refs
(Grant NGR-32-003-037)
(NASA-CR-101689) CFSTI CSCL 17B

This work is concerned with establishing a parameter space for acceptable operation of a PLL in a low signal to noise environment. An analog simulation of the IF model was used to establish and partition the parameter region into areas of acceptable operation. The input carrier to noise ratio determines the parameter of operation. Author

N69-30296# General Dynamics Corp., Groton, Conn. Electric Boat Div.
ANALYTICAL INVESTIGATIONS OF DIGITAL INFORMATION PROCESSING SYSTEMS, VOLUME 3 Progress Report
Taylor L. Booth Oct. 1968 48 p refs
(Contract Nonr-2512(00))
(AD-684839; U417-68-099-VOL-3) Avail: CFSTI CSCL 17/1

The aim of this project is to provide basic knowledge of the methods which may be used by a man-computer system to detect the presence of a target, using data from a passive sonar receiver. This research consists of analytical studies to evaluate important system parameters and experimental investigations measuring operator performance under various operating conditions. The report contained in this volume investigates the problem of extracting information from a sequence of binary signals. The optimum method of estimating present values of the sequence, predicting future values, and smoothing past values are presented. Author (TAB)

N69-30324# Naval Medical Field Research Lab., Camp Le Jeune, N.C.
DEVELOPMENT OF THE NMFRL TELEMETRY SYSTEM, VOLUME 19, NUMBER 2
Wade G. Holcomb and Philip J. Rasch Jan. 1969 21 p refs
(AD-682690; Rept-9) Avail: CFSTI CSCL 6/2

Studies were conducted to determine whether 33.1 MHz or 143.52 MHz provided better transmission for the telemetering of physiological data through dense forest growth. It was determined that 33.1 MHz was definitely superior. Problems encountered and the steps which will be taken to overcome them are reported. Author (TAB)

N69-30332# Lincoln Lab., Mass. Inst. of Tech., Lexington.
THE MICROWAVE SYSTEM OF THE HAYSTACK PLANETARY RADAR
Clarence W. Jones 23 Oct. 1968 72 p refs
(Contract AF 19(628)-5167)
(AD-685696; ESD-TR-68-329; TR-457) Avail: CFSTI CSCL 3/2

The microwave system of the Haystack Planetary Radar is described and performance data presented. A detailed description of techniques and components is included for those cases which are not representative of common usage or where the state of the art has been advanced. Author (TAB)

N69-30356# Institute for Defense Analyses, Arlington, Va. Systems Evaluation Div.
PRELIMINARY EVALUATION OF ELECTROGRAPHICS FOR MILITARY COMMUNICATIONS
Jerry S. Kidd (Maryland Univ.) and Thomas G. Belden Sep. 1968 30 p refs
(Contract DAHC15-67-C-0011)
(AD-684844; N-578) Avail: CFSTI CSCL 17/2

The present note describes a preliminary study of the use of electrographic media in military communications. An electrographic medium is a device which permits the instantaneous transmission of handwritten or handsketched messages. Such a device is, in effect, an electronic pantograph. The initiator writes a message or draws a diagram on a plane surface. The position of the initiators writing instrument on the surface is sensed, the position information is transmitted to a remote station, and a writing instrument at the remote station is driven to a corresponding position. Author (TAB)

08 COMPUTERS

Includes computer operation and programming; and data processing. For basic research see: 19 Mathematics.

N69-29024# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FUNDAMENTALS OF THE MEMORY AND DESIGN OF DIGITAL COMPUTERS, VOLUME 2
B. V. Anisimov et al Nov. 1968 278 p refs Transl. into ENGLISH of the publ. "Osnovy Teorii i Proektirovaniya Tsifrovykh Vychislitelnykh Mashin" Moscow, Mashgiz., 1965 p 1–483
(AD-684376; FTD-HT-23-412-68-Vol-2) Avail: CFSTI CSCL 9/2

Contents: Memory units; Arithmetic units; Peripheral equipment; Control and monitor units; and Fundamentals of electronic digital computer construction. TAB

N69-29080# Argonne National Lab., Ill.
GUIDE TO ACCESSING MULTIFILE MAGNETIC TAPES FROM FORTRAN PROGRAMS UNDER OS/360
Cynthia Chamot Oct. 1968 24 p refs
(Contract W-31-109-ENG-38)
(ANL-7507) Avail: CFSTI

The ASP, JCL, and FORTRAN specifications for creating and retrieving information on multifile magnetic tapes are presented. Also included are samples of DD cards that work, and lists of error indications that are obtained when these specifications are not followed. The emphasis is on using a different data set reference number for each file on tape to facilitate accessing arbitrary files of information. Author (NSA)

N69-29081# Argonne National Lab., Ill.
THE FORTRAN–PL/I INTERFACE PROBLEM
Michael T. Matthies Nov. 1968 30 p refs
(Contract W-31-109-eng-38)
(ANL-7435) Avail: CFSTI

The implementation of two techniques that provide for the establishment of a FORTRAN– PL/1 interface is described. This is not intended as a programmer's guide, but rather as a thorough discussion of the linkage and communication areas that allow PL/1 and FORTRAN to be dynamically combined. The means for explicit and implicit passage of data types compatible to both languages is examined. This requires a study of two types of PL/1 object time data-declaration blocks, namely, the string and array dope vectors. A brief discussion of the aspects of the internal control structures of PL/1 and FORTRAN, related to linking the two languages, is also included. Author (NSA)

N69-29160 Pennsylvania Univ., Philadelphia.
STATISTICAL DESIGN OF SAMPLED-DATA CONTROL SYSTEMS VIA QUADRATIC PROGRAMMING
Anthony John Calise (Ph.D. Thesis) 1968 88 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-71

Quadratic programming is applied to the statistical design of linear sampled-data control systems. Given a fixed plant, a compensator is chosen which minimizes the mean-square value of an error sequence subject to a set of constraints. The system inputs are described in terms of sampled values from autocorrelation and cross-correlation functions, eliminating the need for the analytical expressions required in the Wiener-Hopf equation. Constraints which characterize the closed-loop response to deterministic inputs and constraints which limit the complexity of the compensating net-work can be simultaneously employed. The solution generates the parameters of the optimum compensator. The case where the error signal is not sampled and where the mean-square value of the error is the index of the performance is also considered. Dissert. Abstr.

N69-29183 Northwestern Univ., Evanston, Ill.
SELF-DIAGNOSABLE DECOMPOSITION OF SEQUENTIAL MACHINES
Douglas Craig Bossen (Ph.D. Thesis) 1968 67 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 69-1799

This dissertation presents a method of accomplishing automatic error detection and fault location in an arbitrary synchronous sequential machine. The technique is in the form of a design method. To this end a class of error correcting codes called redundant residue polynomial codes is derived. It is shown that the application of these codes to the state assignments of a sequential machine results in the realization of a given sequential machine as a generalized decomposition into component machines. This decomposition has the property that any state transition error made by one of the component machines is automatically detected and the faulty component machine located. The faulty component may be removed for repair, or a replacement may be switched in to replace it. The amount of additional hardware required both for redundancy and for the decoding circuitry is shown to be modest. Dissert. Abstr.

N69-29251 Stevens Inst. of Tech., Hoboken, N.J.
AN ABSTRACT COMPUTER WITH A LANGUAGE RELATED TO COMBINATORY LOGIC
Bruce Osborn Larsen (Ph.D. Thesis) 1968 157 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 68-16218

A computer programming language, L*, which is closely related to LISP, is introduced. A second language, M*, based on combinatory logic is defined and it is shown that any expression in L* can be translated into M*, provided the same primitive constants and functions are used. M* is an extremely simple language, having but one elementary operation, called application, and as few as two elementary operators. It is possible to make certain transformations on an expression in M* without altering the meaning of the calculation it represents. Also, in some special cases it is possible to determine whether two expressions represent the same calculation. An abstract computer with M* as its machine language is set forth. Dissert. Abstr.

N69-29267 Pennsylvania Univ., Philadelphia.
COMPUTER-ASSISTED DIRECTORY SEARCH
Hamilton Irving Rothrock, Jr. (Ph.D. Thesis) 1968 143 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-164

This dissertation explores the interaction of telephone information operators, who use keyboards as input devices and cathode ray tubes as output display devices, with a proposed computer system in which telephone directory information has been stored. In particular, the following have been accomplished: (1) A strategy for automatically initiating telephone directory file searches has been devised; (2) A means of implementing the telephone director file search-initiation strategy to work with the keying strategy, while simultaneously protecting the computer system against operator keying error, has been devised to demonstrate that the solution is realistic in terms of state-of-the-art computer storage and real time capabilities. Dissert. Abstr.

N69-29276 Pennsylvania Univ., Philadelphia.
A SYSTEM DESCRIPTIVE LANGUAGE AND ITS USES
Donald Francis Gorman (Ph.D. Thesis) 1968 345 p
Avail: Univ. Microfilms: HC $15.75/Microfilm $4.45 Order No. 69-110

Design automation is a discipline devoted to the use of computers in the design, engineering and manufacture of a product. Systems design includes those activities that take place from the time a product is conceived until the physical and practical considerations required for an implementation are brought to bear upon the design. One of the reasons that design automation has not progressed on the systems level is the lack of an adequate language for describing the functional operation of the components of a digital system. A descriptive language especially tailored to the unique characteristics of information processing systems, called the System Descriptive Language (SDL II) is defined. This language provides a unified description of both the hardware and the systems software as they progress through the various stages of design. In SDL II, there are four viewpoints from which a system may be described: behavioral, functional, structural, and implementational. Dissert. Abstr.

N69-29287*# Radio Corp. of America, Somerville, N.J.
MONOLITHIC PARALLEL PROCESSOR Progress Report, 28 Jun.–27 Dec. 1968
27 Dec. 1968 100 p
(Contract NAS5-11577)
(NASA-CR-101566) Avail: CFSTI CSCL 09B

A four-bit parallel processor was designed. The logic design conforms to the contract objectives. The array of 750 devices was laid out on a chip 145 mils by 155 mils. A composite drawing was completed and rubyliths were prepared. Extensive checking of the rubylith was used to reduce the probability of error in the layout. A test matrix was developed to permit testing of the processing and control portions of the parallel processor. Author

N69-29329 Pennsylvania Univ., Philadelphia.
ERROR CONTROL IN FORMAL LANGUAGES
William Bridges Smith (Ph.D. Thesis) 1968 151 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 69-175

This paper investigates the effects that certain classes of errors have on formal languages. In particular, it is concerned with the preservation of languages under error transformations and the construction of automata to correct languages which have been subject to these errors. The work reported in this paper was motivated by the need to provide better error control for compilers. An automaton that detects that errors have occurred in an input from a given language is merely a recognizer of that language. However, an automaton that determines if errors in the input are bounded in some manner is a recognizer of a larger, error-modified language. It is these latter automata with which we are primarily concerned. Dissert. Abstr.

N69-29365 New York Univ., N.Y.
A SOLUTION TO THE HIDDEN-LINE PROBLEM FOR COMPUTER-DRAWN POLYHEDRA
Philippe Paul Loutrel (Ph.D. Thesis) 1968 103 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 69-583

The hidden-line problem for computer-drawn polyhedra is the problem of determining, by means of a computer algorithm, which edges or parts of edges of a polyhedron are visible from a given vantage point. The objective of the research described in this thesis was to find an efficient solution to the hidden-line problem. This thesis describes an edge classification scheme that eliminates at once most of the totally invisible edges. To test the remaining edges, called potentially visible edges, a starting point is chosen and the number of faces hiding this point, called the order of invisibility, is computed. This original order of invisibility is transmitted, with the proper modifications, to all the edges of a path originating at the starting point. A vertex test is introduced to compute the variations in order of invisibility whenever new edges from a vertex are to be included in the path. Dissert. Abstr.

N69-29469# System Development Corp., Santa Monica, Calif.
COMPUTERS AND PRIVACY IN SOCIAL SCIENCE DATA ARCHIVES
Robert C. Bristeon Mar. 1969 14 p ref Presented at the 4th ann. Council of Social Sci. Data Arch. Conv., Pittsburgh Univ., 13 Jun. 1968
(AD-685438; SDC-SP-3315) Avail: Issuing Activity CSCL 5/11

This paper is a revised version of the talk which introduced the Panel on Privacy at the Council for Social Science Data Archives (CSSDA) 1968 Annual Conference. A framework for inquiry into issues of computers and privacy is reviewed and categories of concern are suggested. Some criteria for evaluation of the use of archives, a brief inventory of protective measures, standards, and limitations of use are summarized. Finally, some concepts, examples, and programs that relate to Social Science Data Archives (SSDA) and manipulation of aggregate data are discussed. Author (TAB)

N69-29478*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A SPACECRAFT ANALOG-TO-DIGITAL CONVERSION SYSTEM EMPLOYING MOSFETS
Donald C. Lokerson Washington Jul 1969 29 p refs
(NASA-TN-D-5228) Avail: CFSTI CSCL 09B

The analog-to-digital conversion systems used in past Interplanetary Monitoring Platform spacecraft are reviewed to indicate why a new voltage-controlled oscillator is required and what characteristics are desirable for the new oscillator. Since the

system developed employs metal oxide semiconductor field effect transistors (MOSFETS), this type of transistor is described. Analysis, design, and developmental innovations are described in detail for the system, which is composed of an analog commutator, a voltage-to-frequency oscillator, an internal voltage regulator, and a digital storage register. The system performance using special calibration equipment is described in detail for the operation over a nominal 0 to +5 volt input with a 5-millisecond sample time. The linearity is within ±0.5 percent of the 6-kHz to 46-kHz frequency range. Tests indicate long-term stability is about ±0.2 percent over a three-month period, whereas short-term stability is ±0.5 percent after warmup. The system described can be adapted to permit measurements at hundreds of megohms impedance. The time constants can be changed to allow a wide range of frequencies and sample times. Author

N69-29493# Los Alamos Scientific Lab., N. Mex.
USERS GUIDE FOR THE TWO TRAN (x, y) PROGRAM
Kaye D. Lathrop 1 Dec. 1968 23 p refs
(Contract W-7405-eng-36)
(LA-4058) Avail: CFSTI

New difference schemes are described for the two-dimensional transport program TWOTRAN. A general guide to the usage of the program is given. Detailed input instructions for the program are provided. Author (NSA)

N69-29592*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
A SIMPLE TECHNIQUE FOR AUTOMATIC COMPUTER EDITING OF BIODATA
Ram Swaroop, (Computing and Software, Inc., Greenbelt, Md.) Kenneth A. West, (Computing and Software, Inc., Greenbelt, Md.), and Charles E. Lewis, Jr. Washington Jul. 1969 20 p refs
(NASA-TN-D-5275) Avail: CFSTI CSCL 09B

Before any data are statistically analyzed, it is always necessary to edit the data to some extent. Furthermore, when large quantities of data are collected, the editing must be performed by automatic means. One common task in the editing process is the identification of observations which deviate markedly from the rest of the sample, commonly known as outliers. A simple statistical technique for identifying the outliers and the necessary computer program is presented. The program requires as input only the data set, sample size, and preselected levels of significance at which outliers are to be identified. It is assumed that the data set is a random sample of size larger than two from a normal population. Two examples are presented to illustrate applications of the described technique. Author

N69-29875*# Louisville Univ., Ky. Performance Research Lab.
PERFORMANCE MEASUREMENT OF NONVERBAL MEDIATION Semiannual Status Report, 1 Oct. 1968–31 Mar. 1969
Ben B. Morgan, Jr. and Earl A. Alluisi 15 Apr. 1969 11 p refs
(Grant NGR-18-002-008)
(NASA-CR-101631; SSR-4; SASR-4) Avail: CFSTI CSCL 09B

Major efforts have been concerned with an investigation of the effects of practice and operator loading on the performance obtained with the digital-readout version of the COTRAN task; data analysis and the preparation of a preliminary report of this study were completed. In addition, the data analysis and report of a pilot investigation of the group-performance version of COTRAN were completed. A prototype group-performance COTRAN apparatus has been constructed as part of the MTP battery and a study is being planned to test this apparatus. Author

N69-29741# RAND Corp., Santa Monica, Calif.
RELATIONAL DATA FILE: INPUT TECHNIQUES
Wade B. Holland Feb. 1969 107 p refs
(Contract F44620-67-C-0045)
(AD-684121; RM-5821-PR) Avail: CFSTI CSCL 9/2

The document is an input manual for the Relational Data File (see AD-642 120), applicable to any high-volume, structured, data base. A general discussion of problems and requirements precedes the rationale for the procedures selected. Designers of machine-processed files tend to neglect input; nearly always this results in inefficient, costly, and highly error-prone manual preprocessing. Input includes all procedures necessary to file data in machinable form, check, correct, maintain, and update it; this report is concerned with the methodology for the manual extraction and preparation of data for input. The aims are flexibility, generality, and efficiency, using the relative strengths of man and machine in appropriate ways. Synonymity and ambiguity dictionaries are needed by both input workers and file programs. Error correction and detection procedures should be built in. Procedures are given for handling tentative, unknown, projected, or negative data, for ambiguous data, and for relative as well as absolute dating. Author (TAB)

N69-29801# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROBLEMS OF DISCRETE EXTRAPOLATION
A. Sh. Blokh 16 Oct. 1968 6 p refs Transl. into ENGLISH from Doki. Akad. Nauk Belorussk. SSR (USSR), v. 11, no. 10, 1967 p 878–879
(AD-685520; FTD-HT-23-946-68) Avail: CFSTI CSCL 9/2

The article is a continuation of previous works by the author in which the problem of pattern recognition and the method of incomplete mathematical induction were interpreted respectively as interpolation and extrapolation of arithmetic functions. A general principle was formulated stating that the arithmetic functions should be definnd in such a way that the algorithm for computation requires a minimum number of memory cells. Problems relating to formulation of this principle for the case of discrete extrapolation are examined in this paper. A simplified model of a control machine is proposed in which memory organization is described by a single table of addresses. The program for computing the arithmetic function is given by a finite or infinite Moore automaton. The automaton may be binary, ternary or some other type, depending on the computational system. Although only binary automata are considered in this article, the results are valid for any Moore automaton in the proper formulation. TAB

N69-29807# Michigan Univ., Ann Arbor.
AN EXECUTIVE SYSTEM FOR A DEC 339 COMPUTER DISPLAY TERMINAL
James H. Jackson Dec. 1968 198 p refs
(Contract DA-49-083-OSA-3050; ARPA Order 716)
(AD-685631; TR-15) Avail: CFSTI CSCL 9/2

This report describes a real-time multiprogramming software system for a DEC 339 computer display terminal, which may communicate with an external computer through a serial-synchronous data set. The system is designed to support both programs which require the attention of an external computer while they are being executed and programs which are independent of external computation service. For either type of program, the entire graphics support is provided by the 339 system, but the interpretation of the relations implied by the graphics may be performed either in the 339 or in an external computer. Multiprogramming facility is provided to facilitate effective use of I/O devices in order to cope with the demands of a real-time environment. Author (TAB)

N69-29840# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OPTIMAL THRESHOLD FOR A SYSTEM OF BINARY STORAGE WITH INDEPENDENT ERRORS
T. A. Valiev Oct. 1968 9 p refs Transl. into ENGLISH from Izv. Akad. Nauk Uz. SSR, Ser. Tekhn. (Tashkent), v. 11, no. 4, 1967 p 41–45
(AD-685530; FTD-HT-23-885-68) Avail: CFSTI CSCL 9/2

Discrete binary storage systems have a number of advantages over continuous storage systems, which make it possible to accomplish balanced summation and signal storage, practically unlimited in time, with the aid of bistable elements. Discrete binary storage is easily accomplished in a computer. The method we suggest for determining optimal discrete threshold is based on analysis of discrete binomial distribution. Author (TAB)

N69-29888# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
COMPUTING MEDIA
E. V. Evreinov 11 Oct. 1968 10 p refs Transl. into ENGLISH from Tr. Simpozium po Vychislitelnym Sistemam (Novosibirsk), 1967 p 109–112
(AD-685508; FTD-MT-24-385-68) Avail: CFSTI CSCL 9/2

The iterative-circuit structure is characterized by these features: homogeneity, close action (between adjacent elements only), universality, program tuning. Any graph, or function of the algebra of logic, or finite automaton can be realized in the iterative-circuit structure. The minimum number of tuning states for a two-dimensional-structure element is three; for a three-dimensional-structure element, two. When the amount of equipment used in a computing system increases by 10-100 times, the iterative-circuit structure is 100-1000 times more efficient than a universal computer built on the same physico-technical basis. Author (TAB)

N69-29871# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE IDEAL MAGNETIZATION OF FERRITE CORES WITH RECTANGULAR HYSTERESIS LOOPS USED AS ANALOG MEMORY ELEMENTS
V. P. Zinkevich Jul. 1968 13 p refs Transl. into ENGLISH from Vopr. Tekhn. Kibernetiki (Moscow), 1966 p 80–85
(AD-684997; FTD-HT-23-421-68) Avail: CFSTI CSCL 9/2

Ferrite-core materials with a rectangular hysteresis loop (RHL) display a structure and physical constants which sharply differ from those of the polycrystalline materials (steel, soft iron) to which normally applies the classical Gans formula of the ratio between reversible susceptibility and magnetization. In this connection, better agreement with the Gans formula may be achieved by considering ideal magnetization, i.e., a case where the magnetization of a substance occurs under the simultaneous action of constant and variable fields of an amplitude that decreases to zero. Ideal magnetization of a material with RHL results in a more uniform distribution of regions with different magnetization directions in the volume of the material as compared, e.g., with magnetization in a constant field; in this case deviation from the Gans curve will not exceed plus or minus 10%. TAB

N69-29898# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ADAPTATION PRINCIPLES IN UNIFORM (ITERATIVE CIRCUIT) STRUCTURES
A. V. Veits 11 Oct. 1968 14 p refs Transl. into ENGLISH from Tr. Simpozium po Vychislitelnym Sistemam (Novosibirsk), 1967 p 177–182
(AD-685519; FTD-MT-24-386-68) Avail: CFSTI CSCL 8/4

The construction of adaptive automata includes, as a leading problem, the determination of mechanisms which ensure the expediency of functioning of such devices with minimum initial information, and the automatic restoration of disturbed functions during a breakdown of certain number of elements. A discussion is given of certain general principles of the construction of adaptive systems, connected with the principle of least excitation (PNV), which can best be realized on uniform structures. The basic concept of PNV consists of the fact that the operation algorithm of one element or a united group of elements is expressed in the minimization of the proceeding afferent flow. Author (TAB)

N69-29904# Massachusetts Inst. of Tech., Cambridge. Electronic Systems Lab.
AN INTEGRATED HARDWARE-SOFTWARE SYSTEM FOR COMPUTER GRAPHICS IN TIME SHARING Technical Report, Sep. 1962–Mar. 1968
Daniel E. Thornhill, R. H. Stotz, D. T. Ross, and J. E. Ward Dec. 1968 182 p refs
(Contracts F33615-67-C-1530; Nonr-4102(01); Proj. MAC)
(AD-685202; ESL-R-356; MAC-TR-56) Avail: CFSTI CSCL 9/2

This report describes the ESL Display Console and its associated user-oriented software systems developed by the M.I.T. Computer-Aided Design Project with Project MAC. Console facilities include hardware projection of three-dimensional line drawings, automatic light pen tracking, and a flexible set of knob, switch, and push-button inputs. The console is attached to the Project MAC IBM 7094 Compatible Time-Sharing System either directly or through a PDP-7 Computer. Programs of the Display Controller software provide the real-time actions essential to running the display, and communication with the time-sharing supervisor. A companion graphics software system (GRAPHSYS) provides a convenient, high-level, and nearly display-independent interface between the user and the Display Controller. GRAPHSYS procedures allow the user to work with element picture parts as well as subpictures to which names are assigned for identification between user and Controller programs. Software is written mostly in the machine-independent AED-0 Language of the Project and many of the techniques described are applicable in other contexts. Author (TAB)

N69-29939*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EXPERIMENTAL USE OF A PROGRAMMING LANGUAGE (APL) AT THE GODDARD SPACE FLIGHT CENTER
Cyrus J. Creveling ed. Nov. 1968 64 p refs
(NASA-TM-X-63569; X-560-68-420) Avail: CFSTI CSCL 09B

This document explains what APL is, and describes the experiment that the Information Processing Division has undertaken to introduce APL to the Goddard Scientific Community. A brief historical sketch of steps taken to date and some illustrative examples of how APL was actually used at the Goddard Space Flight Center are presented. Author

N69-29940*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
BIT ERROR ANALYSIS FOR A PCM EQUIPMENT USING INTEGRATE AND DUMP MODE OF DATA REGENERATION
William E. Thomson (Chile Univ.) May 1969 16 p
(NASA-TM-X-63585; X-530-69-203) Avail: CFSTI CSCL 09B

An analysis of the performance of an integrate and dump circuit when used for PCM data regeneration is presented. This analysis is made using the circuit's transfer function. The influence of the circuit parameters is also analyzed and some conclusions are reached which can be used as design criteria. Author

N69-29962*# Stanford Research Inst., Menlo Park, Calif.
TECHNIQUES FOR THE REALIZATION OF ULTRARELIABLE SPACEBORNE COMPUTERS Interim Scientific Report
J. Goldberg, M. W. Green, K. N. Levitt, and H. S. Stone Oct. 1967 127 p refs
(Contract NAS12-33)
(NASA-CR-86156; ISR-2) Avail: CFSTI CSCL 09B

The development techniques for the realization of ultrareliable, high-performance, spaceborne computers are reported. The techniques developed are in support of computer structures in which reliability is achieved through autonomously controlled logical reconfiguration and fault masking. A multiprocessor model is described that is particularly appropriate to the attainment of ultrareliability. Local design techniques, which facilitate reconfiguration, are discussed for various computer functions, including memory and microprogram control. Design techniques are presented for economical, fault-tolerant, data commutation networks. An initial effort is being directed toward a formal description of program-design techniques that will facilitate hardware diagnosis and, hopefully, yield mistake-free programs. Author

N69-29976# California Univ., Los Angeles. School of Engineering and Applied Science.
LOGIC DESIGN AND INTERFACE OF A LINCOLN WAND SYSTEM
T. A. Makranczy Feb. 1969 133 p refs
(Contract AT(11-1)-GEN-10; Nonr-233(52); N00014-67-A-0111-0016; ARPA SD-184)
(AD-685285; UCL-10P14-71; Rept-69-11) Avail: CFSTI CSCL 9/2

A description of the design and interface of a 3-dimensional graphic input device is presented. The system functions as an auxiliary input device to a general purpose digital computer. The Lincoln Wand uses a sonic delay technique to periodically sample the position of a pen-sized stylus. This principle was developed by L. Roberts at the Lincoln Laboratory. The system described here was specially designed to interface with the Graphics Station developed jointly by the Variable Structure Computer, Computer Instrumentation and Digital Technology projects. The basic operating principles are presented and pertinent characteristics of the SDS Sigma 7 Computer and Graphics Station are described. A chapter is devoted to familiarizing programmers with the systems software and operational characteristics. The control logic is explained with logic diagrams, timing charts and logic equations. A data reduction algorithm and assembly language program are described. This program was timed using a software timing technique. The technique and results are furnished. Analysis of errors and resolution of the device are treated. Author (TAB)

N69-30011# European Atomic Energy Community, Ispra (Italy). Reactor Physics Dept.
FRANCESCA: A DYNAMIC PROGRAM FOR BOILING COOLING CHANNELS
G. Forti 1969 49 p refs
(EUR-4241.e) Avail: CFSTI

The Fortran program FRANCESCA for IBM 360 is a dynamic code for boiling channels. The physical model is one-dimensional, and includes subcooled boiling and optionally superheating of the liquid in the bulk boiling zone. The finite difference method of calculation is employed, with up to 100 mesh points in the active part of the channel and 10 more points in the riser. The program is intended for forced circulation and highly pressurized systems, for which the pressure drop in the channel may be considered negligible compared to the general pressure level, so that the coolant fluid properties may be assumed independent of space and time. The driving pressure may be taken as a quadratic function of the mass flow, to simulate pump characteristics, or given as a time table. The power distribution in the heating element is given as a fixed arbitrary shape, while the power level is any tabulated function of the time. Author

N69-30014*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
A COMPILATION OF CURRENT COMPUTER PROGRAMS FOR LOW-THRUST TRAJECTORY ANALYSIS
Alfred C. Mascy Washington Jul. 1969 68 p
(NASA-TM-X-1824) Avail: CFSTI CSCL 09B

A catalog of brief descriptions of current low-thrust trajectory and mass computation programs is presented. All known sources were contacted, and questionnaires were sent to those who indicated that they possessed such codes. A total of 59 descriptions of computer programs pertinent to this discipline are compiled. They are capable of generating flyby and rendezvous trajectories with their associated mass computation. Included in the codes are those capable of variable thrust trajectory as well as constant thrust with coast trajectory calculations. No attempt is made to evaluate any computer code or in any way compare programs; rather, the descriptions of existing codes are presented. Further details concerning a particular program may be obtained from the organization shown on each description. Author

N69-30039*# Massachusetts Inst. of Tech., Cambridge.
ON-LINE LOGICAL SIMULATION (OLLS) Summary Report
H. R. Howie, G. Schwartz, and H. A. Thaler Apr. 1969 72 p
(Contract NAS12-130)
(NASA-CR-86154; E-2410) Avail: CFSTI CSCL 09B

The status of a project to develop a computer-aided design system is summarized as to its present operational capability and future goals. A batch processing card system, designated MAC 360, is reported in use, with a limited file capability in which the logical device models are an integral part of the program. The future configuration is to include a major list-processing system, called FILLIP, with a CRT interface. A recent milestone in the development of the FILLIP language was the implementation of a stored file capability, which allows for the creation, deletion, calling, and disk storage of the FILLIP files. The CRT system was designed with a data structure similar to that used by FILLIP and was implemented by machine language subroutines so that the program can operate on a larger file than the available CPU core capacity. A.C.R

N69-30047# Commissariat à l'Energie Atomique, Bordeaux (France). Centre d'Etudes Scientifiques et Techniques.
TEST PROCESSING INTEGRATED SYSTEM (SIDEX) [SYSTEME INTEGRE DE DEPOUILLEMENT EXPERIMENTATION (SIDEX)]
Maurice Sabas, Hubert Oules, and Didier Badel Mar. 1969 43 p In FRENCH; ENGLISH summary
(CEA-R-3666) Avail: CFSTI

The Test Processing Integrated System is mainly composed of a CAE 9080 (equivalent S.D.S. 9300) computer with a 100,000 samples/sec acquisition system. The system is designed for high speed data acquisition and data processing on environment tests and also calculation of structural models. Such a digital appliance for data processing has many advantages compared to conventional methods based on analog instruments. Author (ESRO)

N69-30075# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENT IN DEVELOPING THE COMPUTING COMPLEX OF A SMALL TRANSISTORIZED DIGITAL COMPUTER

V. S. Zubov 20 Sep. 1968 20 p refs Transl. into ENGLISH from Kibernetika (USSR), 1967 p 172–183
(AD-685152; FTD-MT-24-322-68) Avail: CFSTI CSCL 9/2

A series of computer circuits and a general-purpose computer arithmetic unit (AU) using those circuits, which were designed at the Moscow Power Engineering Institute, are described. The following circuits were designed: flip-flop, an element realizing gating-fan-in-shaping a decoder element performing a logical function z = x1 xy1 xy2 xy3 xy4 xy5, a pulse-stretcher, an inverter, and a passive delay line. All circuits are based on P-16 transistors, which use a -12-volt and +2.5-volt bias supply. The circuits are designed to operate at 400kHg clock frequency in a -20 - +60C temperature range. The authors also describes a 40-bit parallel arithmetic unit operating on numbers in the floating point mode. The AU based on these circuits features a structure the implementation of which resulted in improved computing speed, reliability, and economy. The machine performs 80,000 additions/sec, 25,000 multiplications/sec, or 10,000 divisions/sec, and uses only 40 transistors and 120 diodes for each bit processed by the AU.
Author (TAB)

N69-30087# Reactor Centrum Nederland, Petten.
MICROFLUX-2: A PROGRAM FOR THE CALCULATION OF THERMAL GROUP CONSTANTS BY SOLVING THE ENERGY AND SPACE DEPENDENT INTEGRAL TRANSPORT EQUATION FOR SLABS, CYLINDRICAL CELLS AND FOR HEXAGONAL AND SQUARE LATTICES
Oct. 1968 177 p
(RCN-94) Avail: CFSTI

The ALGOL program MICROFLUX-2, based on the space and energy dependent integral neutron transport equation calculates thermal group constants in slabs, cylindrical Wigner Seitz cells and in hexagonal and square lattices with maximum two different sorts of rods. Maximum cut-off is 2.5 eV. Condensation in more than one thermal group is possible. Options are made to apply the Doppler correction to cross sections near resonance lines, to calculate selfshielding factors in grains of burnable poison of any composition in any material, and to introduce so called external elements for the calculation of activation ratios. The user can choose from the scattering models of Brown and St. John, Koppel Young (KY) and others. For anisotropic scattering corrections can be made by adapting the diagonal elements of the scattering matrices. Microscopic cross sections and KY matrices are compiled in the library THERMALIBR. The program is in operation on a 48 K PHILIPS ELECTROLOGICA X8 computer. This report presents a review of the theory, a short description of the ALGOL program and THERMALIBR and a user's manual together with a sample problem. In the appendices are included the text of the ALGOL program MICROFLUX-2, a list of elements and isotopes of which the cross sections are compiled in THERMALIBR and a list of temperatures and isotopes for which the KY matrices are given in THERMALIBR.
ESRO

N69-30134# Fondazione Ugo Bordoni, Rome (Italy).
CELLULAR CIRCUITS WITH TREE STRUCTURE [CIRCUITI CELLULARI CON STRUTTURA AD ALBERO]
Giacomo Cioffi and Vincenzo Falzone 6 Dec. 1967 29 p refs In ITALIAN
Avail: CFSTI

A universal cellular circuit with tree structure is described. Any logical function of 'n' variables may be realized, according to the truth table, by setting the value of the control bits. Circuit diagrams are presented and diagnosis in case of failure is discussed.
ESRO

N69-30194# Mitre Corp., Bedford, Mass.
SYNCHRONIZATION STUDY FOR THE IRIG 102-64 DATA FORMAT
J. T. Barrows Mar. 1969 24 p refs
(Contract AF 19(628)-5165)
(AD-685694; MTR-522; ESD-TR-67-411) Avail: CFSTI CSCL 17/2

An analysis is made of synchronization properties of patterns suitable for incorporation in the 240 bit standard IRIG 102-64 word format. Sequences of length m = 7, 13 and 17 bits are used as prefix of an (240-m) bit randomly generated word. An analysis which includes a digital simulation is made to determine the synchronization capabilities of each of those sequences. In the first part of the study, for a randomly generated 240 bit word, the average number of false sync sequences generated and the probability of obtaining at least one false sync were computed for each prefix and confirmed by simulation tests. The sync sequences were then appended to the (240-m) bit word and the sync process was defined. The process was simulated for each prefix to determine the number of words lost before acquiring sync and the number of false syncs.
Author (TAB)

N69-30228# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ALGORITHM FOR ISOLATING IMAGE CHARACTERISTICS
V. S. Vainshtein et al Nov. 1968 12 p Transl. into ENGLISH of the book "Avtomaticheskoe Chtenie Teksta" Moscow, 1967 p 171–175
(AD-684837; FTD-MT-24-387-68) Avail: CFSTI CSCL 9/2

An algorithm is proposed for a pattern recognition problem in which local characteristics of a pattern are used. An image evaluation function is introduced.
TAB

N69-30237# Lincoln Lab., Mass. Inst. of Tech., Lexington.
BLOCK-FLOATING-POINT REALIZATION OF DIGITAL FILTERS
Alan V. Oppenheim 20 Mar. 1969 16 p ref
(Contract AF 19(628)-5167)
(AD-685698; TN-1969-19; ESD-TR-69-63) Avail: CFSTI CSCL 9/2

A realization for digital filters using block-floating-point arithmetic is proposed. A statistical model for roundoff noise is presented and used to compare block-floating-point with fixed-point and floating-point realizations.
Author (TAB)

N69-30263# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN INFORMATION AND CONTROL SYSTEM BY INTERCONNECTED COMPUTERS
S. R. Buachidze Jul. 1968 10 p refs Transl. into ENGLISH from Tr. Inst. Gruz. Politekhnicheskii (Tiflis), no. 1, 1965 p 95–100
(AD-685138; FTD-HT-23-278-68) Avail: CFSTI CSCL 9/2

Concepts of elements of the system are introduced: the external and internal objects of the computer as well as the intermediate connecting link. One of the systems computers handles the function of the distributor of load between the other computers and (or) of the basic data storage center for the system. Owing to the presence of correlation between objects the correlation control method is employed to determine damage to elements of the computer-connecting link-object circuit. A classification of computers from the standpoint of object-servicing speed is presented. The distribution of load between computers according to the criterion of time assures an increase in the speed of servicing of the object and may avert the danger of the overloading of computers. When methods of mathematical programming are applied, allowance is made for the systems ability to operate in modes with elements of frequently varying quality--objects, intermediate links and the computers themselves.
Author (TAB)

N69-30267# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ODRA-1003 UNIVERSAL DIGITAL COMPUTER
S. Tomaszewski Jul. 1968 8 p Transl. into ENGLISH from the publ. "Sredstva i Metody Mekhanizatsii Podgotovki i Poiska Nauchno-Tekhnicheskoi Informatsii, Inzhenernogo i Upravlencheskogo Truda. Lektsii, Prochitannye na Vystavke 'Inforga-65'. 1965" Moscow, 1965 p 167–170
(AD-685140; FTD-HT-23-281-68) Avail: CFSTI CSCL 9/2

A compact, transistorized, universal digital computer, using printed circuits, is described. While mainly used for scientific computations, it can be adapted for process control by means of a special analog-to-digital converter. The ODRA-1003 is a binary, fixed and floating point, cyclic machine. It contains 7 index registers and its memory consists of a magnetic drum with 8192 40-bit word capacity. It performs about 1500 fixed point additions per sec, 850 floating point additions, and 350 floating or fixed point multiplications of divisions per sec. The input devices are a photoelectric paper tape reader (300 symbols per sec) or a teletype. The output consists of a paper tape perforator (150 symbols per sec) and a teletype. ODRA-1003 works with 3 programming languages: (1) Main language, consisting of pseudocommands. (2) Symbolic addresses language, consisting of commands coded by 5 octal numbers each. (3) Autocode MOST-1, structurally related to ALGOL-60. TAB

N69-30271*# Hughes Aircraft Co., Fullerton, Calif.
RESEARCH IN THE EFFECTIVE IMPLEMENTATION OF GUIDANCE COMPUTERS WITH LARGE SCALE ARRAYS Interim Report
J. J. Pariser, F. D. Erwin, J. F. McKevitt, J. A. Burke, C. P. Disparte et al May 1969 95 p refs
(Contract NAS12-665)
(NASA-CR-86155; FR-69-11-621; IR-1) Avail: CFSTI CSCL 09B

A study of an effective method of implementing guidance computers is reported. The approach used applies functional logic characters to the selected system design of the NASA modular computer (NMC) as represented by a modular computer breadboard (MCB). The characters are specified as the building blocks and a repertoire of microprogram instructions is defined. The character set totals ten unique building blocks. There are three logic characters, one register character, three micromemory-related characters, and three miscellaneous characters (scratch pad memory, real-time clock, and switch). A micromemory word contains instruction and constant fields. Based on available information of the MCB computer, a design of each of the five units was completed using the functional characters. The design of each unit in general includes selecting proper characters and microprogramming each micromemory to provide proper logical interaction of characters within a unit and between units to furnish all specified MCB machine instructions and operations. An evaluation of the implementation of the MCB using functional characters is given. The preliminary implementation results in favorable operating time and a reasonable hardware count. Author

N69-30289# RAND Corp., Santa Monica, Calif.
FINITE STATE QUEUE AUTOMATA
R. L. Bisbey Mar. 1969 9 p refs
(AD-685125; P-4051) Avail: CFSTI CSCL 5/7

The paper examines the power of a finite-state machine equipped with a queue (FIFO list), henceforth called an FSQA (Finite State Queue Automata). Author (TAB)

N69-30362# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FUNDAMENTALS OF THE MEMORY AND DESIGN OF DIGITAL COMPUTERS, VOLUME 1
B. V. Anisimov et al 8 Nov. 1968 202 p Transl. into ENGLISH of the book "Osnovy Teorii i Proektirovaniya Tsifrovykh Vychislitelnykh Mashin" Moscow, Mashinostr., 1965 p 1–195
(AD-684392; FTD-HT-23-412-68-Vol-1) Avail: CFSTI CSCL 9/2

This manual intended for students in schools of higher education, has been compiled for use in a course entitled Mathematical and Computing Instruments and Devices. It can also be used by technical personnel concerned with the design of digital computers. The manual discusses the theory and design of digital computers, methods for calculating basic logic circuits and digital computers based on various physical principles. The manual is based on lectures delivered by the authors during a period of several years at the Moscow School of Higher Technical Education. Volume I contents: Electromechanical digital computers; Electronic digital calculating machines; and Basic computer logic elements and components. TAB

N69-30373# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
PROJECT ECHO: A STUDY OF LEARNING SYSTEMS FOR SYMBOL MANIPULATION TASKS
C. M. Vossler Jun. 1969 36 p
(CAL-VG-2150-Y-1) Avail: Issuing Activity

Research into concepts for achieving artificial intelligence through computer implementation of evolving competitive hierarchical organisms (ECHO) is described. The work was conceived in the context of inductive problem-solving using symbol string manipulation as a basis for problem characterization. An approach to artificial intelligence was evolved which uses reward/punishment and performance feedback concepts of considerable generality. The approach incorporates heuristics at a fundamental level for mutation and in the definition of basic operators or logical building blocks from which evolving automata are constructed. It differs from the host of approaches to "pattern recognition" in that it incorporates competitive evolution among many simultaneously existing automata, and direction of evolution by both performance (effectiveness) and complexity (cost) influences as fundamental principles. Author

N69-30384# McDonnell-Douglas Co., Long Beach, Calif.
FORMAT: FORTRAN MATRIX ABSTRACTION TECHNIQUE. VOLUME 6: DESCRIPTION OF DIGITAL COMPUTER PROGRAM, PHASE 1 Final Report, Jan. 1967–Jun. 1968
J. P. Cogan, R. C. Morris, J. E. Serpanos, and J. R. Wells Wright-Patterson AFB, Ohio AFFDL Dec. 1968 711 p refs
(Contract F33615-67-C-1258)
(AD-683262; DAC-33569-Vol-6; AFFDL-TR-66-207-Vol-6) Avail: CFSTI CSCL 20/11

Contents: Program organization; Description of major submodules; FORMAT III Phase I error messages; and FORMAT III Phase I routines. TAB

N69-30385# McDonnell-Douglas Co., Long Beach, Calif.
FORMAT: FORTRAN MATRIX ABSTRACTION TECHNIQUE. VOLUME 5: ENGINEERING USER AND TECHNICAL REPORT Final Report, Jan. 1967–Jun. 1968
J. Pickard Wright-Patterson AFB, Ohio AFFDL Dec. 1968 701 p refs
(Contract F33615-67-C-1258)
(AD-683261; DAC-33569-Vol-5; AFFDL-TR-66-207-Vol-5) Avail: CFSTI CSCL 20/11

FORMAT (Fortran Matrix Abstraction Technique) is a digital computer program system consisting of three distinct programs written entirely in Fortran IV. The system provides for generation, manipulating, printing, and plotting of large order (i.e., 2000) matrices commonly used in state-of-the-art structural analyses. Phase I of the system automatically generates matrices required in the thermomechanical analysis of structures by the Force or

Displacement Methods including those necessary in joining, symmetric/antisymmetric r reaction disconnect, vibration, and stability analyses. Modules for converting continuous-to-discrete loads, and analytic-to-discrete geometry and for maintenance of a master case data file are also provided to minimize input data requirements. Phase II provides an abstraction capability to effect basic matrix algebra via the standard matrix operations (e.g., add, multiply, etc.), and several control operations (e.g., save and print matrices, etc.). The sequence of operations is user designated. Phase III provides for self-explanatory report form printing of matrix data resulting from Force or Displacement Method analyses, and a nominal graphical display capability for matrix and geometry data. Author (TAB)

N69-30386# Bell Aerosystems Co., Buffalo, N.Y.
MAGIC: AN AUTOMATED GENERAL PURPOSE SYSTEM FOR STRUCTURAL ANALYSIS. VOLUME 3: ENGINEERS MANUAL Final Report
Daniel DeSantis Wright-Patterson AFB, Ohio AFFDL Jan. 1969 376 p refs
(Contract F33615-67-C-1505)
(AD-685191; AFFDL-TR-68-56-Vol-3) Avail: CFSTI CSCL 20/11

The volume is designed to facilitate implementation, operation, modification, and extension of the MAGIC System. Author (TAB)

N69-30387# Bell Aerosystems Co., Buffalo, N.Y.
MAGIC: AN AUTOMATED GENERAL PURPOSE SYSTEM FOR STRUCTURAL ANALYSIS. VOLUME 1: ENGINEERS MANUAL Final Report
Robert H. Mallett and Stephen Jordan Wright-Patterson AFB, Ohio AFFDL Jan. 1969 232 p refs
(Contract F33615-67-C-1505)
(AD-685190; AFFDL-TR-68-56-Vol-1) Avail: CFSTI CSCL 20/11

An automated general purpose system for analysis is presented. This system, identified by the acronym MAGIC for Matrix Analysis via Generative and Interpretive Computations, provides a flexible framework for implementation of the finite element analysis technology. Powerful capabilities for displacement, stress and stability analyses are included in the subject MAGIC System for structural analysis. The matrix displacement method of analysis based upon finite element idealization is employed throughout. Six versatile finite elements are incorporated in the finite element library. These are: frame, shear panel, triangular cross-section ring, toroidal thin shell ring, quadrilateral thin shell and triangular thin shell elements. These finite element representations include matrices for stiffness, incremental stiffness, perstrain load, thermal load, distributed mechanical load and stress. Author (TAB)

N69-30400# RAND Corp., Santa Monica, Calif.
SOVIET CYBERNETICS: RECENT NEWS ITEMS, VOLUME 3, NO. 1
Dorothy McDonald, ed. and Wade B. Holland, ed. Jan. 1969 75 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(AD-683770; RM-6000/1-PR) Avail: CFSTI CSCL 9/2

The January 1969 SC:RNI, the first issue to appear in the RM series, features an article by Minsk Factory director V. Goldberg suggesting that Soviet computer producers be made responsible for the introduction, installation, servicing, and basic software of their products (at present, systems are often shipped unassembled). Another article discusses requirements for high-level compiler languages for engineering problems. Although 60 new journals have been added since 1966 and older ones enlarged, the backlog of unpublished results grows and lead time after submission averages 18 months. Academy natural-science journals will give at least one-fourth of their space to brief communications and annotations of reports that are not printed but deposited for request copying; institutes are urged to give authors editorial help and to distribute reprints. Also included: specifications for process control computers that are not met by present Soviet equipment; a cutaway view of the Soyuz-3 spacecraft; Georgian research on voice recognition; Armenian development of pneumonic (airjet) controls; demographic forecasting in the Ukraine; biographical sketch of radio scientist V. A. Kotelnikov. The Academy of Sciences has translated into Russian the latest edition of the manual for the Norwegian simulation language, SIMULA. Author (TAB)

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N69-29061 Pennsylvania Univ., Philadelphia.
AN INTEGRATING DIGITAL ELECTRONIC ACQUISITION SYSTEM AND A PHOTOMETRIC STUDY OF TW CASSIOPEIA
George Patrick McCook (Ph.D. Thesis) 1968 128 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 69-143

The use of digital equipment at small observatories has been somewhat hindered by the high cost of this type of equipment. The total cost of the components of this system is approximately $3000. The system has been designed for use with a photoelectric photometer. The system is capable of integrating the DC voltage supplied by the photometer amplifier for periods of from 10 to 50 seconds or longer if necessary. The photometric study of the eclipsing binary TW Cas was conducted to resolve the conflicts appearing in the literature concerning this system. A total of 649 observations in yellow and 651 in blue were used to determine the orbital elements. The solution indicates that the primary eclipse is a partial occultation. The binary appears to be a semi-detached system composed of a B9 main sequence star of normal mass and radius and an early G type subgiant. Dissert. Abstr.

N69-29090# Stanford Univ., Calif. Electronics Labs.
SPECTRAL DISTORTION OF NOTCH FILTERED FM SIGNALS IN SATURATED AMPLIFIERS
R. C. Cumming and E. G. Oppoboni Jan. 1969 40 p refs
(Contract AF 33(615)-3589)
(AD-684733; SU-SEL-68-104; TR-2040-1) Avail: CFSTI CSCL 9/5

In certain applications, a narrowband spectral notch may be desired in the output spectrum produced by a wide band interference system. Unfortunately, nonlinear effects in saturating power amplifiers can severely degrade a spectral notch applied at the amplifier input. Theoretical and experimental studies of this phenomenon are presented for notch filtered FM signals. The experiments used a TWT amplifier, and the measured results are presented graphically. The TWT input was an FM signal followed by a notch filter. In specific situations of interest, a perfect notch at the TWT input degrades to a 6-dB notch at the output. This and other results are presented and shown to agree well with theoretical predictions. Author (TAB)

N69-29116 Illinois Univ., Urbana.
AN ALGORITHM FOR NAND DECOMPOSITION OF COMBINATIONAL SWITCHING FUNCTIONS
Edward Steinberg Davidson 1968 242 p
Avail: Univ. Microfilms: HC $11.05/Microfilm $3.15 Order No. 69-1329

A branch-and-bound algorithm is presented for the synthesis of multi-output, multilevel, cycle-free NAND networks, to realize an arbitrary given set of partially or completely specified combinational switching functions. Minimum cost solutions are obtained under a specified cost function which may be any non-negative integer linear combination of the number of gate inputs and gates of a solution network. Other solutions, not necessarily of minimum cost, are produced by the algorithm during the search for a minimum cost solution. A wide variety of network constraints are compatible with the algorithm and can easily be introduced. The completeness, consistency, and finite convergence of the algorithm are proven. Several versions of the algorithm are implemented in computer programs. Dissert. Abstr.

N69-29130 Newark Coll. of Engineering, N.J.
THE MECHANISM OF SECOND BREAKDOWN IN TRANSISTORS
Eugene David Fabricius (Ph.D. Thesis) 1968 210 p
Avail: Univ. Microfilms: HC $9.45/Microfilm $3.00 Order No. 68-16971

The purpose of this dissertation is to examine the behavior of electrons and holes in a semiconductor or diode under conditions of high current density as a function of temperature, and to relate this behavior to the phenomenon of Second Breakdown. The approach used is that of magnetohydrodynamics, the electrons and holes being treated as a plasma gas embedded in the dielectric of the semiconductor. The author is convinced that there are two types of second breakdown, depending upon the emitter bias. The first type of second breakdown occurs when the emitter-base junction is forward-biased, in which case current constrictions are due to pinching of electrons and holes in the base region of the device. The theory predicts that second breakdown is due to thermal effects at or near room temperature, and due to magnetic effects at or near liquid nitrogen temperature. The second occurs when the emitter-base junction is reverse-biased, in which case current constrictions are due to avalanche effects in the collector-base junction. Theory predicts that devices are much more easily driven into second breakdown at low temperatures than at high temperatures, and this is verified experimentally. Dissert. Abstr.

N69-29133*# Chrysler Corp., Huntsville, Ala. Electrical and Electronic Engineering Dept.
A STUDY OF TRUE PRODUCT MODULATORS, PHASE 3 Final Report
W. M. Summers 16 Feb. 1968 35 p refs
(Contract NAS8-21198)
(NASA-CR-61726; HEE-M17-68) Avail: CFSTI CSCL 09E

Complete results of the study are summarized, but the largest portion of the report involves the description, design, development, and test of a field effect transistor (FET) true product modulator. The modulator concept is based on the variable channel conductance characteristic of the FET. This modulator dissipates very little power, is small and lightweight, and exhibits commendable performance at room temperature. An electrical breadboard model of the modulator was constructed and evaluated. Commendable modulator performance is exhibited at room temperature but degradation is apparent at higher or lower temperatures. Therefore, it is concluded that this modulator is suitable for use in ground based telemetry applications, but resolution of thermal deficiencies is necessary before it can be utilized in an aerospace environment. Author

N69-29155 Illinois Univ., Urbana.
OPTO-ELECTRONIC SWITCHING MATRIX
Tuh-Kai Koo (Ph.D. Thesis) 1968 117 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-1373

A cross-bar type switching matrix system with photoconductive cells as basic switching elements and an optical signal as the switching driving source has been studied and developed. The basic switching unit contains three photoconductive cells in T-connection, in which the center branch is grounded and the two arm branches are connected to input and output channels, respectively. Switching action is accomplished by scanning the matrix panel with a programmed helium–neon laser beam. The equivalent circuit of a photoconductive cell under the specific application has been developed. The complete equivalent circuit contains harmonic terms which are the consequence of optical beam scanning. These harmonic terms interact mutually with each other. First degree approximation has to be used to reduce the equivalent circuit to a practically usable form. Dissert. Abstr.

N69-29184 Pennsylvania Univ., Philadelphia.
THEORY OF THE INSULATED GATE FIELD EFFECT TRANSISTOR
Harry Thomas Freestone (Ph.D. Thesis) 1968 83 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 69-99

The purpose of this dissertation is to provide a unified theoretical analysis of the insulated gate field effect transistor (IGFET). A mathematical model will be developed which describes the characteristics of the IGFET, below, through and above pinch off; that is, a single equation will be developed which characterizes FET performance throughout the entire range of operation. The gradual channel solution assumes an infinitely thin conducting layer. The mobile channel charge is determined from the one dimensional Poisson equation, leading to a channel conductivity which is a function of the transverse electric field only. The transverse electric field is approximated. Dissert. abstr.

N69-29200# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
ANALYTICAL CHAIN
A. Pages, B. Delaitre, M. Avril, R. Moreau, P. Hameau et al [1968] 3 p In FRENCH Presented at Intern. Symp. on Nucl. Electron., Versailles, France, 10 Sep. 1968
(CEA-CONF-1157; CONF-680906-16) Avail: AEC Depository Libraries

In order to improve the resolution of an analysis chain, a proportional amplifier, a pile-up eliminator, a linear switch, and a fast analyzer with 1 to 8 channels were studied. The essential characteristics of the proportional amplifier and the linear switch are given. These four elements assembled make it possible to obtain, with a generator peak mixed with signals from a photomultiplier, a resolution of 1/1400 at half amplitude. NSA

N69-29209# Nihon Univ., Tokyo (Japan).
APPLICATION OF A SYNCHRONIZED SAMPLING TECHNIQUE TO THE MEASUREMENT OF QUASI-PERIODIC VELOCITY FLUCTUATIONS
Hiroyuki Komoda and Naoko Hando *In* Md. Univ. Advan. in Hot-Wire Anemometry Jul. 1968 p 71–85 refs (See N69-29201 16-14)
Avail: CFSTI

A synchronized sampling circuit was built, and the performance was tested by using a sine wave input, a step pulse input, and a 100 cps test signal which simulates a quasi-periodic velocity fluctuation. The circuit was proved to be capable of separately

measuring both the periodic part (a mean value) and the turbulent part of the signal. The frequency response extends from dc to 20 kc. A 10-channel synchronized sampling device was used successfully to measure the periodic part of velocity in a study of the development of instability waves in a laminar boundary layer. Author

N69-29218# Colorado State Univ., Fort Collins. Research Center.
THE DESIGN OF A CONSTANT TEMPERATURE HOT-WIRE ANEMOMETER
C. I. Finn and V. A. Sandborn *In* Md. Univ. Advan. in Hot-Wire Anemometry Jul. 1968 p 219–243 refs (See N69-29201 16-14)
Avail: CFSTI

New circuitry for turbulence measurements was developed for improving the flexibility of hot-wire anemometers. A transistor circuit of modular construction was included for greater flexibility in selecting operating requirements, utilizing a dual-wire heating current system. A constant current source and a feedback amplifier were employed to heat the wire to near operating conditions and to maintain it at a constant temperature. The advantages of this system over other similar techniques include the capability of tailoring the feedback amplifier to the turbulent fluctuation requirements, thus allowing the use of a low power amplifier with more stability and less noise. A second advantage is the greater impedance characteristics which do not restrict the system to limited cable size or length. The modular construction allows use of amplifiers to cover the range of fluctuations encountered in any specific flow condition. It is reported that a micro-miniature, integrated circuit, constant temperature, hot-wire anemometer is working in the breadboard stage, and its future applications are briefly discussed. Author

N69-29250 Northwestern Univ., Evanston, Ill.
TRANSIENT FIELDS OF THIN CYLINDRICAL ANTENNAS
Raymond Joseph Palciauskas (Ph.D. Thesis) 1968 132 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 69-1906

The transient radiation fields of a thin cylindrical antenna driven by a DC pulse and by step-amplitude modulated sine wave are investigated theoretically. An analysis is sought which is sufficiently rigorous to provide a sound qualitative understanding of the time variation of the radiation field and which results in readily computable expressions for these fields. The antenna considered was a tube of length 2h and of infinite conductivity. A potential was applied across a zero width gap at the midpoint of the antenna. The driving signals are represented by a finite number of terms of the Fourier series for a rectangular pulse. Computed values of the radiation field are presented graphically for successive instants of time as a function of the angle θ between the antenna-axis and the position vector of the distant point in space relative to the center of the dipole, and for different θ angles as a function of time. Integrated radiation field waveforms are interpreted and the individually resolvable portions of the waveforms are justified on a physical basis. Dissert. Abstr.

N69-29271 Oregon State Univ., Corvallis.
A SIGNAL-PROCESSED ANTENNA SYSTEM AND THE SIMULATION OF THE EFFECTS OF BALANCED-MIXER FREQUENCY CONVERSION
Kenneth Edward Spencer (Ph.D. Thesis) 1968 182 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 69-462

A signal-processed antenna and receiver system is proposed and analyzed. In addition, a simulation of the balanced-mixer portion of the processing system is made on a hybrid computer to find the bandwidth limitations for the total system. The system utilizes both the amplitude and phase information of a one-dimensional antenna array as compared to only amplitude information for normal antenna systems. The proposed processing system is analyzed by using a simplified model for the balanced-mixer portion of the processor. The analysis is done both for a processor with a CW local oscillator and for one with a pulsed local oscillator. The analysis shows that, in addition to the normal amplitude factors in the processor output signal and in the effective electric field pattern, a phase-dependent amplitude factor is obtained. Dissert. Abstr.

N69-29302# Brookhaven National Lab., Upton, N.Y. Accelerator Dept.
NOTE ON THE DISPERSION RELATION OF PERIODIC CAVITY CHAINS WITH TWO COUPLED PASSBANDS
Internal Report
T. Nishikawa (Tokyo Univ.) Dec. 1968 29 p refs Supported by AEC
(BNL-13348; AADD-150) Avail: CFSTI

An elementary consideration of the general behavior of two coupled oscillating systems is presented, and the relation between the general behavior and the dispersion relation for the ideal cavity chain with two coupled passbands is shown. Some practical problems are considered which may cause the analyses based on the idealized model to be in inapplicable. Also, the effects of symmetry mixing, nonuniform cell distributions, and wall losses are discussed. Author (NSA)

N69-29333 Stanford Univ., Calif.
EFFICIENT TESTING OF COMBINATIONAL LOGIC CELLS IN LARGE-SCALE ARRAYS
Enn Tammaru (Ph.D. Thesis) 1968 128 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 69-301

The characteristics are investigated that regular cellular arrays must have in order that each cell can be tested from the peripheral terminals of the array. The nominally identical cells in the array have n inputs and n outputs, where each of the n outputs is some combinational function of the n input variables of the cell. Of special interest is the characterization of cells and arrays in order to predict whether defective cells can be not only tested but also located within the array. Logic cells are shown to exist which, when interconnected into appropriate arrays, can be evaluated with a small number of array tests so as to answer one or more of the following questions: (1) Are all cells in the array flawless? (2) Is one cell defective, and if so, where is it? (3) Are there two or more defective cells? Dissert. Abstr.

N69-29337 Stanford Univ., Calif.
THEORY OF POLAR-DISPLAY SIGNAL ANALYZERS, AND A RADIO DIRECTION-FINDING ANALOGY
Glen Allen Myers (Ph.D. Thesis) 1968 148 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 69-265

Wideband frequency-sensitive devices, in conjunction with suitable amplifiers, detectors, and display devices, may be used advantageously as spectrum monitors and signal analyzers in radio receivers or instrumentation systems. Two related signal-analyzer techniques of this type are studied. A polar display is an inherent feature of these techniques. The display appearing on the screen of a cathode-ray tube operated in an x-y mode either indicates the types and numbers of signals received in spectrum monitoring applications or presents various important signal parameters in signal-analysis applications. This report presents for the first time the form of the polar display resulting when the input signal is a modulated sine wave, simultaneous sine waves, and noise. Dissert. Abstr.

N69-29374*# General Electric Co., Philadelphia, Pa.
PHOTOVOLTAIC POWER SYSTEMS ON FLIGHT SPACECRAFT LUNAR ORBITER 3
C. J. Drazdauskas and M. D. Read 26 May 1969 303 p refs
(Contract NAS7-547)
(NASA-CR-100700; Doc-69SD4225) Avail: CFSTI CSCL 09E

Design and performance of the power subsystem in the Lunar Orbiter 3 are described, with emphasis on data serving the interests of power system design engineers. For the purpose of the report, the power system is defined as all those subsystems and discrete assemblies that exist for the function of supplying electrical power to the spacecraft. This includes the solar array, battery, and the associated electronics comprising the battery charge regulator, shunt relator heat dissipation elements, and circuits required for the power subsystem telemetry. In addition to background information on the project and summaries on the spacecraft and its mission, the report covers power subsystem performance, components, quality assurance, solar array tests, costs, spacecraft tests, parts anc materials lists, and technical problems that were encountered. K.W

N69-29449# Naval Research Lab., Washington, D.C.
THE SCATTERED-FIELD RESPONSE OF A LINEAR ARRAY TO A STEP-FUNCTION ILLUMINATION Final Report
Oliver D. Sledge 13 Feb. 1969 35 p refs
(ARPA Order 820)
(AD-685197; NRL-6823) Avail: CFSTI CSCL 9/5

A limited investigation is made of the scattered-field response of a linear array of center-loaded cylindrical elements illuminated by a plane electromagnetic wave with a step function of time variation. The theoretical approach utilizes fourier's theorem to express the transient response as a sum of the steady-state responses to the individual sine-wave components of the step-function illumination. The number of array elements and their spacing can be determined simply from the time variation of the backscattered field, provided the angle of incidence of the illumination is known and adequately large to separate the component transient waves. In the case of an n-element array, it is found that the transient field scattered in any arbitrary direction in the H plane can be represented as a summation of N appropriately time-delayed components, each with the same time variation as the field scattered in the reflected direction but with an amplitude reduced by a factor of 1/N. Author (TAB)

N69-29485# New Mexico State Univ., University Park. Physical Science Lab.
RESEARCH AND DEVELOPMENT OF ANTENNAS FOR ROCKET AND SATELLITE DATA TRANSMISSION Final Scientific Report, 1 Jun. 1966–31 Dec. 1968
Bruce T. Buller and Dennis G. Henry Jan. 1969 17 p
(Contract AF 19(628)-5923)
(AD-685666; PSL-PR00623; AFCRL-69-0069) Avail: CFSTI

Research and development studies were conducted on antenna designs for data transmission under contract to Air Force Cambridge Research Laboratories. The studies constituted of two major tasks: the development of telemetry antenna designs for the 2.2 GHz to 2.3 GHz frequency band, and the development of antenna designs for specific mission applications. The former task was a general investigation leading to development of a prototype antenna designs for research rockets and some satellites. In the latter task, antenna systems were developed and implemented for specific use on satellites launched on Scout and Atlas vehicles, on an ejectable 24-inch sphere, and on various rockets and satellites as directed by contracting officer. Summaries of work performed on these tasks are present in the report. Author (TAB)

N69-29501# Technische Hochschule Hannover (West Germany). Fakultaet fuer Maschinenwesen.
THERMAL RESISTANCE DETERMINATION ON DISC-CELL TYPE SILICON RECTIFIERS AND SILICON THYRISTORS [WAERMEWIDERSTANDSBESTIMMUNG AN SILIZUMGLEICHRICHTERN UND SILIZIUMTHYRISTOREN IN SCHEIBENZELLENBAUWEISE]
Rainer Gloeckel (Ph.D. Thesis) 1968 177 p refs In GERMAN
Avail: CFSTI

Two methods for measuring directly the stationary thermal resistance of large-diameter (33 mm) disc cells are described; they are the heat flow method and the heat flow compensation method. The measuring error in both methods is approximately ±3%. In both methods, the temperature gradient produced at the disc cell by means of a fixed axial thermal current is used to determine the thermal resistance. In the compensation method, an electrical load is applied to the disc cell in addition to the thermal load; this permits testing of the arc-through at the same time. The measured results were compared with calculated values and were found to agree. The heat flow method, which is the simpler of the two, was furthermore improved for adaptation in quality control of large-scale production. Transl. by K.W.

N69-29541# New Mexico State Univ., University Park. Physical Science Lab.
TELEMETRY, COMMAND, AND BEACON ANTENNAS FOR THE OV1-16 SATELLITE Interim Report
Dennis G. Henry Jan. 1969 26 p
(Contract AF 19(628)-5923)
(AD-685465; SR-5; PSL-PT00621; AFCRL-69-0041) Avail: CFSTI CSCL 9/5

The design of the antenna systems for the OV1-16 Satellite are presented. Array phasing, impedance, and radiation patterns are given for the telemetry, command, and beacon antenna systems. The polarizations tested during radiation pattern measurements are those used by the actual ground stations. Author (TAB)

N69-29719# Centralny Instytut Informacji Naukowo-Technicznej i Ekonomicznej, Warsaw (Poland). Scientific Publications Foreign Cooperation Center.
TRANSISTOR LINEAR GATE
Stefan Pachala et al *In its* Nukleonika, vol. 11, no. 11/12, 1966 1967 p 65–74 refs (See N69-29712 16-24)
Avail: CFSTI

The design, operation, and characteristics of a linear gate embodying a p–n–p type germanium transistor employed as a gating element are described. Comparison is made of the efficiency of the gating transistor in the case of inversion and ordinary operation. The pulse-forming system and the coincidence system, both operating in conjunction with the gate described, are presented. These systems were designed as part of the complex device serving for the investigation of gamma radiation of ^{60}Co by the coincidence method. Author

N69-29739# Stanford Univ., Calif. Solid-State Electronics Lab.
INVESTIGATION OF GaAs SUB x P SUB 1-x ALLOYS FOR HIGH SPEED CURRENT-LIMITING DEVICES
A. Majerfeld Jan. 1969 35 p refs
(Contract AF 33(615)-3589)
(AD-685272; SU-SEL-68-005; TR-5118-1) Avail: CFSTI CSCL 9/5

The GaAsxP1-x single crystals used in the devices were grown by a vapor phase epitaxial technique. A brief description is presented and contact preparation is also described. The relative advantages and disadvantages of sandwich-like and planar-like

structures are discussed, with emphasis on the differential resistance expected in the saturation range. The effects of temperature on diode characteristics are considered. Resistivity, mobility, Hall-coefficient, photoresistivity, and photo-Hall measurements are reported for crystals of alloy compositions near x = 0.70. Conclusions resulting from the experiments and plans for further research are discussed. TAB

N69-29771# Naval Ordnance Lab., White Oak, Md.
STRIPLINE APPLICATIONS OF HIGH DIELECTRIC CONSTANT MATERIALS
Alan J. Ramsbotham and Donald L. Wilson Dec. 1968 27 p refs
(AD-685222; NOLTR-68-203) Avail: CFSTI CSCL 9/1

The report discusses the use of high dielectric constant materials in microwave stripline circuits. Theoretical analyses and experimental data are included and discussed. Author (TAB)

N69-29773# Federal Aviation Administration, Atlantic City, N.J. National Aviation Facilities Experimental Center.
EVALUATION OF PROTOTYPE DOPPLER VOR SIDEBAND ANTENNA MONITOR Final Report
Virgil E. Willey Jun. 1969 107 p
(FAA-NA-69-19) Avail: CFSTI

The results of evaluation tests of a prototype Doppler VOR sideband antenna monitor are presented. The monitor utilizes a bandpass spectrum analysis technique for the detection of a faulty sideband antenna. The ability to detect a sideband antenna fault deletes the requirement of two of the three VOR monitors presently used in the monitoring of a Doppler VOR navigational facility. Author

N69-29777# Lincoln Lab., Mass. Inst. of Tech., Lexington.
EXPERIMENTAL RESULTS OF A sin x DIVIDED BY x TAPPED-DELAY-LINE MATCHED FILTER
Carl M. Steinmetz 28 Jan. 1969 21 p
(Contract AF 19(628)-5167; ARPA Order 498)
(AD-685212; ESD-TR-69-3; TN-1969-7) Avail: CFSTI CSCL 9/5

A (sin x)/x bandpass filter was constructed using tapped-delay-line techniques. Measurements were taken of its performance as a matched-filter for a rectangular pulse-modulated input. The simplicity of its construction and absence of tuning adjustments along with providing a good approximation to an ideal filter are the main advantages of this technique. Author (TAB)

N69-29778# Lincoln Lab., Mass. Inst. of Tech., Lexington.
RESEARCH AND DEVELOPMENT OF HIGH SPEED PROCESSOR ARRAYS Interim Report, 22 Jul.–21 Oct. 1968
Jan. 1969 18 p Prepared for MIT
(Contract AF 19(628)-5167)
(AD-685215; ESD-TR-47; IR-1) Avail: CFSTI CSCL 9/5

A research and development program directed toward the development of high density, high performance, complex digital arrays and their application in high speed system feasibility studies is under way. The design effort included establishment of layout design rules and the design of the basic high speed ECL gate which will be employed in the processor arrays. Computer aid is being employed to generate photomask designs. Development of high yield microcircuit and multilevel interconnection techniques has continued. A microcircuit study vehicle, to be used in studying the thermal aspects of packaging high density arrays has been designed and fabricated. Author (TAB)

N69-29865# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
AN EXPERIMENTAL STUDY OF COLLINEAR AND PLANAR ARRAYS
V. W. H. Chang Jan. 1969 20 p refs
(Contracts N00014-67-A-0298; F19628-68-C-0030)
(AD-685830; TR-583) Avail: CFSTI CSCL 9/5

Measurements are described that serve to verify a recently reported new theory of arrays of arbitrarily located parallel elements including especially ones that are collinear and staggered. Since the theory takes full account of the effects of mutual coupling in determining the distributions of current in each element of an array, the experimental studies involved the determination of distribution of current and charge as well as admittances and field patterns. Since the theory should be a good approximation for dipole elements well over a wavelength long, complete measurements are reported for arrays of both half-wave and full-wave elements in collinear and planar arrangements. Experimental and theoretical results are in good agreement. Author (TAB)

N69-29883# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
UNIDIRECTIONAL MEDIUM-WAVEBAND LOG-PERIODIC ANTENNA
E. M. Zhurbenko et al 23 Jul. 1968 9 p refs Transl. into ENGLISH from MEIS. Tr. Nauchno-Tekhn. Konf. Prof.-Prepodavatelskovo Sostava (Moscow), 1967 p 182–184
(AD-685540; FTD-HT-23-356-68) Avail: CFSTI CSCL 9/5

The characteristics of a zig-zag-shaped log-periodic antenna operating in the medium wavelength band were studied. The geometric shape of the antenna is specified by three parameters: the effective length L, the angles alpha between the antenna axis and the end elements, and the scale multiplier tau. Expressions for the antenna directional pattern were first derived, and then the characteristics of an antenna with alpha sub s = alpha sub E = 25 degrees and tau = 0.95 were checked experimentally. The antenna was made from copper wire 2 mm in diameter. An unacceptably wide main lobe and large side lobes were obtained for the antenna. To improve the directional pattern and decrease the side lobes, the angle alpha sub s was decreased from 25 degrees to 17 degrees. With an angle of 17 degrees, the average directional pattern was 40 degrees at the half-power points in the frequency band from 600 to 950 MHz; the level of side lobes was in the range of 30%. TAB

N69-29912* Philco Corp., Blue Bell, Pa. Microelectronics Div.
THE STUDY OF INFRARED EVALUATION IN QUALIFICATION AND FAILURE ANALYSIS OF SEMICONDUCTOR DEVICES Interim Progress Report, 28 Apr.–28 Jul. 1968
W. M. Berger and R. H. Soltau 28 Jul. 1968 33 p
(Contract NAS8-21219)
(NASA-CR-98484; IPR-4) Avail: CFSTI CSCL 09E

A progress report is presented on the development of valid infrared techniques and acceptance criteria for use in the qualification of microcircuits, and establishment of detail procedures by which infrared analysis and evaluation techniques may be used to perform the failure analysis of semiconductor devices. Work performed included the study of localized heating at scratches in interconnecting metalization patterns; the evaluation of heating patterns exhibited by electrically good and electrically defective microcircuit devices of identical construction; the evaluation of localized heating at vias in bilayer metalized devices; and the initiation of a study of heating and cooling rates of discrete diffused components to optimize the conditions necessary to generate most significant infrared information. Author

N69-29927# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

TUNED FILTER IN A WAVEGUIDE

P. Kard 18 Oct. 1968 17 p refs Transl. into ENGLISH from Izv. Akad. Nauk Eston. SSR, Ser. Fiz.-Mat. i Tekhn. Nauk (Tallinn), v. 16, no. 3, 1967 p 330–336

(AD-685495; FTD-MT-24-342-68) Avail: CFSTI CSCL 9/1

The theory of tuned optical filters is applied to waveguide filters. A rectangular (or cylindric) waveguide with walls of infinite conductivity, filled with two dielectrics separated by a perpendicular plane, is examined. The dielectrics have different dielectric constants and permeabilities. Formulas analogous to the Fresnel formulas for reflection and refraction of light by the boundary of two media are used. The main formulas are derived (on the basis of the theory of multilayer optical films) in matrix form for the reflection and transmission coefficients for the TE and TM modes. If the refractive index of one of the dielectrics is sufficiently small, its wave number can become imaginary, resulting in total reflection with nonoblique incidence. Frustrated total reflection is also found to be possible and provides a basis for constructing a narrow band tuned filter for a waveguide. Author (TAB)

N69-29936# Norwegian Inst. of Tech., Trondheim. Electronics Research Lab.

INTERDIGITAL ELECTRODE TRANSDUCERS FOR THE EXCITATION OF ELASTIC SURFACE WAVES IN PIEZOELECTRIC MEDIA

H. Engan Sep. 1967 67 p refs

(TE-91; NTNF-B-1770) Avail: CFSTI

The potential distribution for the electrode configuration is found. For the specific case of waves propagating in the y-plane along the x-axis in α-quartz the coupling is calculated. Experimental determination of the impedence agrees well with the theoretical value. Losses are found to be quite small compared with other excitation methods for elastic surface waves. Using movable electrodes the dependence of phase velocity on direction in the three principal planes of α-quartz have been measured. The measurements agree very well with calculated values. In a certain sector two waves propagating along the surface were found. One of these was an ordinary surface wave while the other one was a leaky wave. Author

N69-30013# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ORGANIZATION OF THE DISTRIBUTION OF INFORMATION IN A SPECIALIZED COMPUTER FOR THE CONTROL OF ELECTRON-BEAM TECHNOLOGICAL PROCESSES OF MICROCIRCUIT PREPARATION

V. P. Derkach 27 Aug. 1968 15 p refs Transl. into ENGLISH from Akad. Nauk UKR. SSR, Inst. Kibernetiki Seminar. Fiz.-Tekhnol. Vopr. Kibernetiki (Kiev), 1967 p 46–55

(AD-685003; FTD-MT-24-267-68) Avail: CFSTI CSCL 9/5

This article describes the organization of information flow within a specialized computer for the control of electron-ray technological processes of microcircuit preparation. Process machine control is effected through an information distributing device whose basic function is the automatic input of frame codes from the computer unit, from punched tape, or from a control console. A second function is the transfer of control to units for the execution of tasks specified within the codes themselves. Each code is divided into registers containing binary words specifying ten parameters, including four position (coordinate) parameters, two integrator parameters, and four parameters governing the number of impulses, the length of an impulse, the length of a pause in an impulse, and the radiation stream intensity value. The information system is block-diagrammed, and its components are discussed. The generation of typical codes is traced with respect to the component diagrams. TAB

N69-30045# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.

ACTION OF COSMIC RAYS ON HEAVILY DOPED SEMICONDUCTORS [INFLUENCE DU RAYONNEMENT COSMIQUE SUR LES SEMICONDUCTEURS A HAUT DOPAGE]

Kazem Ozvaminian Mar. 1969 24 p refs In FRENCH; ENGLISH summary

(CEA-BIB-137) Avail: CFSTI

After a short survey of the nature and characteristics of cosmic rays, this bibliographic report gives an analysis of their action on semiconductor junction devices. The degradation of normal diodes and transistors is briefly described, while the case of heavily doped junctions is more thoroughly examined, pointing up the fact that they are more resistant to cosmic ray damage. Author (ESRO)

N69-30061*# Stanford Research Inst., Menlo Park, Calif.

LOW-TEMPERATURE THERMIONIC EMITTER Interim Scientific Report, 9 Feb. 1968–8 Feb. 1969

D. V. Geppert, B. V. Dore, and R. A. Mueller 19 May 1969 33 p refs

(Contract NAS12-607; SRI Proj. PMU-7147)

(NASA-CR-86159) Avail: CFSTI CSCL 09E

Four types of cathodes were tested to ascertain current densities and life expectancies of various types of alkaline earth oxide electron emitters at reduced temperatures. The four cathode types tested were evaporated barium oxide, sputtered triple carbonate, triple carbonate-photoresist, and conventional triple carbonate sprayed cathodes. Schottky data were taken on the diodes following activation of the cathodes and again near the termination of the program. A tabulation of Richardson constants and thermionic work function values shows the changes that occurred in the emission characteristics following life testing or accumulated shelf life. It has been demonstrated that the process for preparing triple carbonate-photoresist cathodes is repeatable and that zero-field, temperature-limited current densities of 750 milliamperes per square centimeter can be obtained at operating temperatures of 600°C. Emission levels an order of magnitude higher than those of the commercially sprayed cathodes were obtained from three cathodes sprayed with a solution of triple carbonate which appeared to be doped with aluminum. Author

N69-30068*# Ryan Aeronautical Co., San Diego, Calif. Electronic and Space Systems.

ENGINEERING MODEL OF AN ELECTRONICALLY SCANNED PHASED ARRAY ANTENNA SYSTEM Final Report

May 1969 131 p refs

(Contract NAS9-7626)

(NASA-CR-99698; Rept-59867-1) Avail: CFSTI CSCL 09E

Development and test phases of the engineering model of an electronically scanned phased antenna system are described. The objective was to establish, through test, the integrity and reliability of electronically phased array antennas with the ultimate goal of integrating a phased array antenna with the electronics of a radar system. This objective has been accomplished and demonstrated by the 4 × 4, C-band, transmitting/receiving, and phased array antenna assembly. Electronic beam steering has successfully been demonstrated for both transmitting and receiving functions by using the step recovery diode (SRD) as a simultaneous microwave multiplier and phase shifter. Author

N69-30079# Commissariat à l'Energie Atomique, Limeil (France).

STUDY OF THE ELECTRICAL BEHAVIOR OF VARIOUS MAGNETOHYDRODYNAMIC GENERATORS USING EXPLOSIVES [ETUDE DU COMPORTEMENT ELECTRIQUE DE DIFFERENTS GENERATEURS MAGNETOHYDRODYNAMIQUES A EXPLOSIF]

Jean Bernard and Jean-Claude Jouys Apr. 1969 80 p refs In FRENCH; ENGLISH summary
(CEA-R-3714) Avail: CFSTI

This report concerns the electric behavior of several types of pulse generators which use the M.H.D. conversion of explosive chemical energy to supply experiments on plasma physics. Their electric parameters and behavior on ohmic and inductive loads are studied and compared. The electrical energy which appears on the load is studied in respect of load and generator characteristics. Ways of amplifying the initial electric energy is also discussed.
Author (ESRO)

N69-30088# Siemens-Schuckertwerke A. G., Erlangen (West Germany).
DEVELOPMENT OF ARC HEATERS OPERATING WITH AIR AS FEED GAS FOR USE IN SPACE FLIGHT TESTING INSTALLATIONS [ENTWICKLUNG VON PLASMABRENNERN FUER LUFTBETRIEB ZUM EINSATZ IN RAUMFAHRT-VERSUCHSANLAGEN
R. Gebel Jan. 1969 134 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. für Wiss. Forsch.
(BMWF-FBW-69-08) Avail: CFSTI

The paper describes 3 types of rotating-arc heater. The first arc heater was operated at a power rating up to 200 kW. It was used to study, amongst other things, the motion behavior of the arc roots and the influence of the air current on the arc root motion. On the second arc heater the magnetic field driving the arc was made very large in order to obtain high arc speeds. The third arc heater was designed for a power of 1 MW. It has movable, large-area cylindrical-shaped electrodes on which the thermal load in the arc root is distributed over a large area. All arc heaters receive their power from rectifiers which operate in conjunction with current-controlled thyristor devices.
Author (ESRO)

N69-30133# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
DATA FOR RELIABILITY COMPUTATION OF ELECTRONIC COMPONENTS [RECUEIL DES ELEMENTS DE CALCUL DE LA FIABILITE DES EQUIPEMENTS ELECTRONIQUES]
Roger Lefèvre, Arnould d'Harcourt, and Guy Dupuy 1968 130 p In FRENCH; ENGLISH summary
(CEA-R-3528) Avail: CFSTI

Data are presented in the form of tables and charts for the easy computation of the reliability of electronic components.
ESRO

N69-30139# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
MAJORITY LOGIC AND THRESHOLD LOGIC: POSSIBLE USES [LOGIQUE MAJORITAIRE, LOGIQUE A SEUIL: UTILISATIONS POSSIBLES
Jacques Uberschlag and Yves Plaige Apr. 1969 14 p In FRENCH; ENGLISH summary
(CEA-R-3787) Avail: CFSTI

In this report circuits for majority logic and threshold logic are briefly presented. Some examples are given where it has been possible to check that the amount of equipment required is much less than in the case where conventional logic circuits are used.
Author (ESRO)

N69-30164# Fondazione Ugo Bordoni, Rome (Italy).
A BINARY SEQUENCE GENERATOR [UN GENERATORE DI SEQUENZE BINARIE]
Giacomo Cioffi and Eugenio Fiorillo 27 Jan. 1968 32 p In ITALIAN
Avail: CFSTI

A binary function generator producing eight parallel independent binary sequences of eight bits each is described. The principles involved and also its design and construction using integrated circuits are discussed in detail. The device consists of a shift register which sends pulses in eight parallel lines, to eight different logic 'or' through a set of manual switches in such a way as to produce any desired set of sequences. Full details of the generator characteristics are given.
Author ESRO

N69-30176*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
DESIGN STUDIES OF A LARGE ELECTRONICALLY STEERABLE PHASED ARRAY
Feb. 1969 285 p refs
(Contract NASr-249)
(NASA-CR-101683; MIT-CSR-TR-69-4) Avail: CFSTI CSCL 09E

Design studies relating to a VHF, electronically controlled, 50 dB antenna are presented. This antenna will be a low noise dipole phased array covering the range 70 to 80 MHz. The purpose and evolution of the array are outlined. The objective has been the design of a large versatile tracking array maximizing the performance per unit cost. Also included are site survey reports, a proposal for the addition of a transmitting function, a description of the Sunblazer spacecraft, and an evaluation of a 128 dipole narrow band pilot system.
Author

N69-30213# Honeywell, Inc., Minneapolis, Minn. Aerospace Div.
MULTIFORMAT ELECTROLUMINESCENT DISPLAY Technical Report, 1 May 1967–15 Jan. 1968
Martin T. Wirth Oct. 1968 170 p refs
(Contract N00014-67-C-0458)
(AD-684848; JANAIR-680103) Avail: CFSTI CSCL 9/5

The objective of the investigation was to analyse and develop solutions to several problem areas which could have potentially precluded effective application of seven inch square, thin-film electroluminescent (TFEL) panels for future airborne multiformat displays. These problem areas were: electrical connection reliability (panel-driver system interface); brightness - nonuniformity (over the whole display); initial turn-on delay (individual lamps); rapid deterioration (individual lamps).
Author (TAB)

N69-30230# Naval Avionics Facility, Indianapolis, Ind.
CODED CIRCUIT ANALYSIS, USERS MANUAL FOR ac, dc, AND TRANSIENT ANALYSIS PROGRAMS
Dec. 1968 104 p
(AD-688618; NAFI-TR-1286) Avail: CFSTI CSCL 9/5

This report contains information about the Computer Oriented Design of Electronic Devices (CODED) Circuit Analysis Programs, procedures for their use, applications, and limitations. The three CODED programs discussed cover AC, DC, and transient analyses.
Author (TAB)

N69-30236*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.
RESEARCH LABORATORY OF ELECTRONICS Quarterly Status Report, 16 Feb.-15 May 1969

Paul Penfield, Jr. 20 May 1969 4 p refs
(Grant NGR-22-009-337)
(NASA-CR-101686) Avail: CFSTI CSCL 09E

A new computer program is being developed for more accurate calculation of large-signal nonlinear transient effects in avalanche diodes. These include the following: (1) traveling-bunch effect; (2) an overvoltage effect, which consists in the transient resulting from applying a voltage larger than the breakdown voltage, and removing the current; (3) the trapped plasma effect, which results whenever an extremely strong transient occurs; and (4) the relaxation effect, which consists in applying a relatively constant current that builds the voltage up past the normal avalanche voltage. If the current is appreciable, the time necessary to initiate breakdown enables the electric field to become so high that much ionization takes place; the higher the current, the farther the voltage breaks back. Suitable combinations of idealized effects such as these can be used to easily explain many different types of large-signal operation of avalanche diodes. Author

N69-30241*# New York Univ., N.Y. Dept. of Biology.
IMPROVEMENTS IN MICROMANIPULATORS
M. J. Kopac and Jack Harris Jan. 1969 13 p refs
(Grant NGR-33-016-067)
(NASA-CR-101690; I-69-1) Avail: CFSTI CSCL 09E

The Mark 14 G micromanipulator, capable of handling six microprobes, includes two units that possess six degrees of freedom. In addition to three degrees of translational freedom, there are pitch, yaw, and rotational degrees of freedom provided by a precision worm gear assembly. This micromanipulator aids in the testing and fabrication of microminiature electronic components including the assembly of piezoelectric bimorphs. The piezoelectric–electromagnetic drive micropositioner utilizes piezoelectric bimorphs for generating y and z movements, and an electromagnetic drive for producing the x movement. All three movements can be remotely controlled, using conventional potentiometers for regulating the magnitude and direction of voltages required to produce the micromovements. Joystick controls can also be employed. The piezoelectric–electromagnetic drive micropositioner can be constructed to occupy a volume of less than 1 cubic centimeter exclusive of the microprobe holder. Author

N69-30261# Potchefstrom Univ. for Christian Higher Education (South Africa). Cosmic Ray Research Unit.
A SIMPLE RC OSCILLATOR WITH HIGH TEMPERATURE STABILITY
Wim Verhagen [1968] 15 p refs
Avail: CFSTI

A stable sine wave generator with a relatively large and constant output voltage over a temperature range of 90°C, and low power consumption is described, using simple active filters and amplitude limiting by means of a stabilized voltage supply. Author

N69-30275# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Institut fuer Flugfunk und Mikrowellen.
CHANCES IN THE DEVELOPMENT OF THE FERROMAGNETIC AMPLIFIER [ENTWICKLUNGSMOEGLICHKEITEN DES FERROMAGNETISCHEN VERSTAERKERS]
C. Thiessen Apr. 1969 55 p refs In GERMAN; ENGLISH summary
(DLR-FB-69-22; DVL-837) Avail: CFSTI

The principal difficulties in the development of the ferrite parametric amplifier are investigated, with special regard to the parallel-pump amplifier. The work consists of partly regarding the existing literature, and partly making calculations and experiments. Special work deals with parallel-pump coupling of magnetostatic modes, relaxation of these modes, and the problem of relaxation oscillation of spin waves. Author

N69-30294# Bolkow Entwicklungen K. G., Munich (West Germany).
ANTENNAS FOR SPACE VEHICLES' A SURVEY OF PROBLEMS AND DESIGNS [ANTENNEN FUER RAUMFLUGGERAETE: EINE UEBERSICHT UEBER DIE PROBLEME UND AUSFUEHRUNGSFORMEN]
H. Koob 28 Feb. 1969 30 p refs In GERMAN; ENGLISH summary
(L-15) Avail: CFSTI CSCL 09E

Special problems of spacecraft antennas are space environment, realization of omnidirectional patterns, aerodynamics and voltage breakdown, as well as omnidirectional pattern measurements. Because of aerodynamic problems there is a great difference between antennas for rockets and antennas for satellites or probes. Typical examples are given for both antenna groups. Author

N69-30301# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INSULATING THE SPOOLS OF HEAT-RESISTANT COILS
D. A. Abramishwili et al Jul. 1968 8 p refs Transl. into ENGLISH from Elektrotekhnika (USSR), no. 12, 1967 p 41–42
(AD-685150; FTD-HT-23-469-68) Avail: CFSTI CSCL 9/1

Previous studies had shown that the composite mica with heat-resistant binder was the best material for insulating steel spools of coils intended for operation at 500C; aluminum-phosphate binders were used for binding and glueing together the spools. Technical details of mica cutting, binder application, pressing, baking, etc., are given. Author (TAB)

N69-30330*# National Aeronautics and Space Administration, Washington, D.C.
HOLLOW CATHODE LAMP: A POWERFUL AID FOR SPECTRAL EMISSION ANALYSIS [RSV-HOHLKATHODENLAMPE]
Jun. 1969 15 p Transl. into ENGLISH of an RSV *Praezisionsmessgeraete G.m.b.H* brochure
(NASA-TT-F-12226) Avail: CFSTI CSCL 09A

An investigation was undertaken to eliminate the disadvantages of the hollow cathode lamp. It was discovered that the lamp provides extremely sharp lines with unusually high light densities at currents of 1 A or more. In glow discharges the length of the free path is the decisive factor for the excitation of the lines. There is an optimum length of the free path for every line (pressure); and the magnitude of the length depends on the excitation energy. This fact requires that the pressure be kept constant. Another advantage of the lamp is that a line reversal due to self-absorption almost never occurs, which lets the indicator lines be used for the quick analysis of high contents. The improved lamp is said to provide for quick specimen change, low vaporization losses, best reproducibility, and easier analysis of radioactive substances; it is also easily disassembled. E.H.W.

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see: Specific Physics Categories.

N69-29052 . Polytechnic Inst. of Brooklyn, N.Y.
A CLASS OF NON-LINEAR UNBIASED ESTIMATORS
John Raymond Krasnakevich (Ph.D. Thesis) 1968 331 p
Avail: Univ. Microfilms: HC $15.10/Microfilm $4.25 Order No. 68-16253

The estimation technique presented by Kalman is appropriate for linear systems, and differential correction estimation has been utilized for nonlinear dynamics. Both estimation techniques employ a model of the signal process with a correction provided by a linear weighting of the differences between the observed and predicted data vectors. In place of the linear compensator a general weighting scheme is employed. Necessary and sufficient conditions are obtained, for the discrete-time case, to minimize the mean-squared error when the class of weights has additive closure. It is demonstrated that there exist classes of weights which yield unbiased estimates, whereas the differential correction estimation results are usually biased. Extensions of these discrete-time results to the continuous-time estimation problem are also presented. Examples are included to illustrate methods of evaluating the weights in terms of the error statistics. Properties of the mean-squared errors for different classes of series weights are also investigated. Approximation techniques are also developed. Dissert. Abstr.

N69-29336 Cornell Univ., Ithaca, N.Y.
WELL-POSED PROBLEMS IN STEADY-STATE ELECTRIC POWER SYSTEMS
Erasmus Chukumezie Ogbuobiri (Ph.D. Thesis) 1968 84 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-15732

The need for "well-posed" problems is discussed with respect to computational algorithms, and two classes of problems -- defined respectively as Loadflow and Optimum Assignment problems -- arising in electric power systems engineering are investigated for existence and uniqueness of solutions. The loadflow problem is very nonlinear in nature and is shown to give rise to a matrix quadratic equation of the form $|\mathrm{diag}(x)|\,{}^{*}Ax + |\mathrm{diag}(x)|\,{}^{*}f + h = 0$, where A is an m-dimensional matrix and x, f, h are m-dimensional vectors, the unknown variables of the equation being elements of x or h. Some unfamiliar but interesting properties of the form $|\mathrm{diag}(x)|\,{}^{*}Ax + |\mathrm{diag}(x)|\,{}^{*}f + h$ are discovered. In particular, it is found that this form does not have some of the nice and established properties of the scalar quadratic form and it is concluded from the results obtained on the form that the conventional loadflow problem is generally "ill-posed." Dissert. Abstr.

N69-29528 Institut des Hautes Etudes Scientifiques, Bures-sur-Yvette (France).
ANOMALOUS PROPERTIES OF THE AXIAL VECTOR CURRENT
Bruno Zumino (N.Y. Univ.) *In* CERN Topical Conf. on Weak Interactions 27 Mar. 1969 p 381-389 refs (See N69-29504 16-24)
Copyright. Avail: Issuing Activity

The Dirac equation for a spinor under the influence of an external electromagnetic potential is considered, along with its adjoint equation; the two equations are combined in a standard way to give a conservation equation for the vector current and a partial conservation equation for the axial vector current. With reference to verifying the axial vector current equation in perturbation theory, the introduction of an extra term is investigated; the use of gauge invariant regularization and the formal use of the operator equations of motion are discussed. A model for the strong interactions given by renormalizable Lagrangian theory with PCAC is then considered. In the presence of an external electromagnetic field, the spinor triangle diagram causes a modification of the PCAC equation, with an additional term giving rise to a non-vanishing amplitude for the $\pi^{0} \to 2\gamma$ decay. It is proposed that the strong interactions do not modify the coefficient of the additional term. Similar phenomena are shown to occur also for charged currents if the strong interaction theory is of the Yang-Mills type with spinors. Some consequencies of the anomalous properties of the axial vector current in this theory are considered. P.A.B.

N69-29631# Technische Hochschule Munchen (West Germany). Institut fuer Technische Elektronik.
ENERGY CONVERSION BY MEANS OF AMORPHOUS INSULATING THIN FILMS
M. Hard and R. G. Mueller Sep. 1968 34 p refs In GERMAN; ENGLISH summary
(BMwF-FBK-68-40) Avail: AEC Depository Libraries

The conversion of radiation energy into electrical energy by means of a photovoltaic effect in sandwich-contacted amorphous insulating films (anodic Ta_2O_5, Nb_2O_5 and CdS) was investigated. Due to their amorphous structure, no radiation damage was expected. Technological problems of the preparation were studied. The quantum yield Q was investigated by irradiating with uv-light: Q has a maximum of approximately 30% in very thin films (100 Å). The dependance on the intensity is linear. Q increases in temperature up to about 150°C. The necessary minimum thickness of the gold top electrode is 100 Å. Experiments as a function of the wavelength (including x rays) confirm that the investigated photoeffect is a bulk effect in the insulator. Author (NSA)

N69-29846# Aeronautical Research Labs., Melbourne (Australia).
USE OF THE COMPLEX IMPEDANCE DIAGRAM IN EDDY CURRENT TESTING
I. G. Scott Oct. 1968 28 p refs
(ARL/MET-58) Avail: CFSTI

The use of complex impedance diagrams is investigated along with an analytical method for the detection of flaws in eddy currents. The diagram is presented according to its use, how it was derived, and its limitations. For the analytical method, it was necessary to separate the effective permeability into real and imaginary points. Attempts to solve the problem with a power series failed, but with the incorporation of Bessel functions some success was obtained. The analytical method helps explain some of the curves which previously had no explanation as to how they were obtained. E.H.W.

N69-29988# Istituto Superiore delle Poste e delle Telecomunicazioni, Rome (Italy).
DIAGNOSIS AND UTILIZATION OF FAULTY UNIVERSAL TREE CIRCUITS
Giacomo Cioffi and Eugenio Fiorillo Fondazione U. Bordoni 24 Sep. 1968 25 p refs
Avail: CFSTI

A method of using universal cellular tree circuits when faulty is presented. However, in general, a faulty circuit is no longer universal i.e. it cannot implement all the switching functions of its input variables. In the first part the types of failure which can take place are defined and a fixed set of tests is determined to control the correct functioning of the circuit. It is also shown that this set is minimal as regards the number of tests. In the second part it is shown how, without having to carry out further diagnostic tests, it is possible to find subtrees of the circuit containing the faulty cells and to determine a set of functions that can certainly be implemented by the faulty circuit. It is also indicated how the signals on the specialization terminals of the circuit must be assigned for this purpose. Author (ESRO)

N69-30027# Istituto Superiore delle Poste e delle Telecomunicazioni, Rome (Italy)
A MODULAR SYNTHESIS FOR SWITCHING FUNCTIONS
Giacomo Cioffi and Vincenzo Falzone Fondazione U. Bordoni 18 Sep. 1968 20 p refs
Avail: CFSTI

The paper deals with the problem of implementing any switching function $f(x_1, x_2 \ldots x_n)$ by making use of only one kind of fixed module. This module is a three input–one output device implementing the function: $f = yx + zx$. The synthesis technique is evolved in two steps. In the first step the function f is written as a sum of disjoined implicants, in such a way that the number of literals is a minimum and all the implicants have at least a common variable (MM-decompositions). In the second step the inputs for every module are determined. The process of MM-decomposition was carried out with Karnaugh maps for functions of six variables as a maximum; for functions of seven or more variables a matrix method is proposed which is programmable on digital computers.
Author (ESRO)

N69-30375# Norges Tekniske Hoegskole, Trondheim. Elektronikklaboratoriet.
CALCULATION OF TRANSIENT RESPONSES FOR A TRANSMISSION LINE WHOSE CHARACTERISTIC IMPEDANCE IS HOMOGENEOUS [BEREGNING AV SPRANGRESPONSEN PA EN TRANSMISJONSLINJE SOM ER AVSLUTTET MED SIN KARAKTERISTISKE IMPEDANS]
Nils Haaheim Aug. 1967 18 p refs In NORWEGIAN
(Elab-TR-90) Avail: CFSTI

The results of a study concerned with data transmission in a cable are presented. The specific task was to find a voltage breakdown with the help of a current generator attached to one end of the cable. The characteristic impedance of the cable was assumed to be matched throughout. It was also assumed that the primary parameters R and G are frequency dependent. Variations in L and C were so small that they were considered to be constant. A GIER computer program is included which was used for determining the responses.
Transl. by K.W.

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N69-29075# Texas A&M Research Foundation, College Station.
THE CONCEPTUAL DESIGN OF A TERRADYNAMICS LABORATORY
F. J. Benson, L. J. Thompson, S. H. Carpenter, and G. H. Ferguson, III 30 Jun. 1968 146 p refs Sponsored by AEC Prepared for Sandia Corp., Albuquerque, N.Mex.
(PB-182823; SC-CR-68-3754) Avail: CFSTI CSCL 14B

Presented is a conceptual design for a terradynamics laboratory in which controlled penetration experiments can be conducted so that empirical penetration can be developed. The experiment was designed and a method to analyze the data is presented. A total of 188 tests are required for vertical penetrations, and the test levels for the experiments were set. It was verified that the high speed electronics and optical data system can obtain the desired data. It appeared that sufficiently uniform soil targets with widely varying properties can be constructed to cover most soils in their various states. A very flexible projectile-velocity generating system was designed.
Author (USGRDR)

N69-29125# National Bureau of Standards, Washington, D.C.
INVESTIGATIONS OF THE EXPLODING WIRE PROCESS AS A SOURCE FOR HIGH TEMPERATURE STUDIES Interim Report
Esther C. Cassidy, Stanley Abramowitz, and Charles W. Beckett Nov. 1968 81 p refs
(AD-681912; NBS-Monograph-109) Avail: CFSTI CSCL 14/2

Numerous experiments with electrically exploded wires are described. The results include time-resolved measurements of electrical energy, power, voltage, and current during the discharge; periodic still and high-speed photographs of the entire explosion process; integrated and time-resolved measurements of the intensity and spectral distribution of the radiation emitted; and time-resolved absorption spectra from the products of the discharge, with emphasis on observations of the spectrum of the AlO molecule. The apparatus, instrumentation, and fast-measurement techniques developed in order to permit these direct experimental observations and measurements, under the extreme and transient conditions of the explosive discharge, are also described. Results from calculations of the composition, entropy, enthalpy, and density of the explosion mixture are given.
Author (TAB)

N69-29588*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
PERFORMANCE OF THE JPL 43-IN. HYPERSONIC SHOCK TUNNEL
Michael F. Blair 15 Mar. 1969 46 p refs
(Contract NAS7-100)
(NASA-CR-101634; JPL-TR-32-1370) Copyright. Avail: CFSTI CSCL 14B

Shock speeds and test times were calculated and measured for the 3-in.-diameter shock tube which supplies the hot gas for the JPL 43-in.-diameter hypersonic shock tunnel. The pressures recorded at, and near the end of the driven tube, both with a closed end and with the shock tunnel attached, were explained and time-resolved. Tailoring, or equilibrium interface operation, was observed for $5.7 \gtrsim M_s \gtrsim 5.4$ for cold H_2 driving N_2. Tailoring Mach number limitation is correlated with mixing due to bifurcation effects. Starting wave speeds were measured and calculated for the hypersonic nozzle, and a pitot survey was made of the working region. The testing region had a Mach number of approximately 12.5 when the 1-in.-diameter throat was used for the nozzle. Attempts to employ flow visualization techniques were unsuccessful.
Author

N69-29632*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
STERILIZATION ASSEMBLY DEVELOPMENT LABORATORY (SADL): FACILITY DESCRIPTION AND CAPABILITIES
G. H. Redmann 15 Jun. 1969 19 p ref
(Contract NAS7-100)
(NASA-CR-101638; JPL-TR-32-1412) Copyright. Avail: CFSTI CSCL 14B

The Sterilization Assembly Development Laboratory described is the result of a research and development program to develop the facilities, equipment, and procedures necessary to meet the biological quarantine requirements established by NASA. These requirements minimize the hazard of introducing viable earth organisms to other planets in the solar system via impacting unmanned spacecraft.
Author

N69-29737*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPECTRAL AND OPERATIONAL CHARACTERISTICS OF A HIGH-INTENSITY CARBON ARC SOLAR SIMULATOR
Ernie W. Spisz and John R. Jack. Washington Jul. 1969 18 p refs
(NASA-TM-X-1825) Avail: CFSTI CSCL 14B

A commercially available high intensity carbon arc solar simulator was evaluated to determine its suitability as a finely controlled radiant source for experimentally determining the solar absorptance of various materials. The spectral distribution of the radiant intensity is determined over the wavelength range from 0.36 to 2.1 μm, and the stability and uniformity of the radiant beam are evaluated. A control system which provides both a constant radiant intensity and a slowly varying sinusoidal perturbation of the radiant intensity is also discussed. Author

N69-29774# Federal Aviation Administration, Atlantic City, N.J. National Aviation Facilities Experimental Center.
EVALUATION OF TALL-TOWER LIGHTING Final Report
Charles T. Johnson Jun. 1969 42 p refs
(NA-69-38; RD-68-53) Avail: CFSTI

A prototype of high intensity rotating obstruction lighting was installed on a TV tower. Testing began to optimize the system and obtain operational parameters satisfying the requirement of providing obstruction identification for at least three miles during three mile meteorological visibility conditions. The variable parameters of the obstruction lighting system were evaluated, and selection of the preferred operational characteristics was completed. It was recommended that white light be used in a minimum of three beacons for each tower providing 40 flashes per minute in a synchronous mode of operation. Such lighting, along with existing tower marking, was considered adequate for protection of associated guy wires, as well as of the main tower structure. Author

N69-29978# Federal Aviation Administration, Atlantic City, N.J. National Aviation Facilities Experimental Center.
RETRO-REFLECTIVE MARKERS AS TAXIWAY VISUAL AIDS Interim Report
Cecil B. Phillips Jun. 1969 40 p refs
(FAA-NA-69-25) Avail: CFSTI

An investigation was conducted to determine the usefulness of retroreflective markers to aid pilots in identifying the edges of taxiways. Retroreflective markers were installed on the edges of two intersecting taxiways and the corresponding fillets. Field observations were made for comparisons among a variety of retroreflective markers. Laboratory measurements of brightness were made of a number of selected markers. A questionnaire was used to collect pilot observations during operational tests. While intensity of the aircraft light and height of the observer above the surface were factors in the observed brightness of retroreflective markers, the major factor was the angle formed by the light source, the reflector, and the observer's eye. The smaller the angle the brighter the reflector appeared. It was determined that on a VFR night, blue retroreflectors were usable to distances of 1,000 feet and more, when illuminated by typical landing lights at typical locations on the aircraft. A study was recommended to optimize location of the aircraft landing and taxi lights. Greatly improved operational use of retroreflectors could result. Author

N69-29981*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DESCRIPTION OF THE HIGH-ENTHALPY ARC TUNNEL AT THE LANGLEY RESEARCH CENTER INCLUDING TEST STREAM CONDITIONS AT SELECTED OPERATING POINTS
William L. Wells. Washington Jul. 1969 52 p refs
(NASA-TN-D-5295) Avail: CFSTI CSCL 14B

The high-enthalpy arc tunnel consists of a 4-megawatt direct current power supply, a 75,000-ft^3 pump-down vacuum system, a commercial long-axial-arc gas heater, a free jet test section, and necessary high-pressure cooling water and test gas systems. Three supersonic conical nozzle lengths are used to provide a wide range of test stream parameters. The nozzle exit radii are 1.00 inch, 2.30 inches, and 3.82 inches. The arc gas heater was operated at chamber pressures from 1.2 to 3.5 atm with corresponding air mass-flow rates from about 0.02 to 0.08 lb/sec. Stagnation pressures behind the normal shock measured at the stream center line cover a range from about 0.03 to 0.72 atm and cold-wall heating rates range from about 200 to 903 Btu/ft^2-sec on a 1-inch diameter flat-faced probe. Calculated enthalpies based on these measurements range from about 10,000 to 13,000 Btu/lb. In all three nozzles, measurements were made of pressure and heating-rate distributions on a specific probe shape. Graphical comparisons show reasonably good agreement between the measured heating-rate distributions and theory and between the measured pressure distributions and data from a tunnel where the flow is known to be smooth and uniform. Author

N69-30162# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
INSTALLATION FOR PRODUCING SEALED RADIOACTIVE SOURCES [INSTALLATION DE FABRICATION DE SOURCES RADIOACTIVES SCELLEES]
Jean Fradin and Charles Hayoun Jan. 1969 198 p In FRENCH; ENGLISH summary
(CEA-R-3622) Avail: CFSTI

An installation has been designed and built for producing sealed sources of the fission elements: cesium 137, strontium 90, promethium 147, ruthenium 106 and cerium 144 in particular. The installation consists of sealed and protected cells, each being assigned to a particular production. The safety and the operational reliability of the equipment are the principal considerations which have governed this work. The report describes the installation, particularly the apparatus used, as well as the various control devices. In conclusion, a review is presented of 9 years operation. Author (ESRO)

N69-30178# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
A NEW RUNNING TEST FACILITY FOR THE STUDY OF FLIGHT DYNAMICS
Akira Azuma, Bunji Tohita, Matsusaburo Iuchi, Masahiko Ishii, (Urage Heavy Ind. Co., Ltd., Japan) Akira Noguchi (Urage Heavy Ind. Co., Ltd., Japan) et al Mar. 1969 49 p refs
(ISAS-437-Vol-34-No-4) Avail: CFSTI

The facility may be used to evaluate the aerodynamic and/or flight dynamic characteristics of a model of aircraft or, specifically, V/STOL aircraft loaded on a carriage which can move on a track by the maximum speed of 10 meters per second. If the model is fixed on the moving carriage low speed aerodynamic characteristics of the model may be obtained by using the internal balance systems installed in the model with similar treatment as well known in the wind tunnel excepting that the model is running instead of flowing the air. If the model is supported on a new free flight system, which can be carried on the carriage, as to be able to fly the model freely for specified directions in any given degrees of freedom, then the flight dynamic characteristics of the model may be evaluated by analyzing the data of the model trajectory which are recorded during the test run. The report includes the detailed description of the design philosophy, simple explanation of the structural outline and arrangement of the equipments, and the test results for the mechanical performance of the facility. Author

N69-30179 Road Research Lab., Crowthorne (England).
A TEST VEHICLE FOR STUDYING THE SKID RESISTING PROPERTIES OF TYRES AND ROAD SURFACES DURING CONTROLLED CORNERING AND BRAKING
C. G. Giles, F. T. W. Lander, and K. E. Holmes 1967 20 p refs
(RRL-LR-99) Copyright. Avail: Issuing Activity

A vehicle is described which has been built and developed to study the skid-resisting forces developed by a passenger car tire during braking, cornering, or combined braking and cornering. The apparatus is built on a 4-ton lorry chassis suitably modified to accommodate within its wheel base a 15 or 16 inch test wheel which carries a load of 350 to 800 lbs. By means of a variable ratio hydraulic drive taken from the vehicle's transmission, the speed of rotation of the wheel can be controlled. The load, and the braking and cornering (sideway) forces acting on the test wheel at speeds from 5 to 60 mph are measured using an electrical resistance wire strain gage unit mounted around the upper king pin of the test wheel suspension. The self-aligning torque developed by the test tire is measured by strain gages attached to the steering arm. The readings from the gages are recorded on film in a multichannel galvanometer recorder. Braking tests can be made in conditions ranging from freely rolling to fully locked cornering tests at inclinations of the wheel from 0° to 20°, and combined tests within these same limits. The results of preliminary tests show that it is particularly suitable for studying the transient conditions through which a braked or cornering tire passes before skidding takes place. Author

N69-30285# Sola Basic Industries, Goldsboro, N.C. Hevi-Duty Electric Div.
NINE HUNDRED WATT VASI POWER SUPPLY Final Report
G. C. Doehler Mar. 1969 28 p
(Contract FA67WA-1798)
(SRDS-RD-69-16) Avail: Issuing Activity

A power supply was designed, built, and tested. Rated at 900 watts to supply 3 light sources with current settings of 4.0 or 6.6 amp. (depending on ambient light and source operating level), it is powered from the runway edge lighting system operating at any current levels between 2.8 and 6.6 amperes. The completed hardware performed in accordance with the requirements set up in the contract specifications. Author

N69-30382# Stanford Univ., Calif.
LEGAL ASPECTS OF AIRPORT NOISE AND SONIC BOOM, PART 1, CHAPTERS 1–7
Lillian R. Altree and William F. Baxter Feb. 1968 214 p refs
(Contract FA-67-WA-1675)
(AD-682900) Avail: CFSTI CSCL 5/4

Contents: Introduction; Basic economics: The nature of airport externalities; The effect of externalities on decision; A theoretical allocation of costs and benefits and some practical limitations; Time-limited easements: A modest step toward solution; Present remedies for losses caused by airport noise. TAB

N69-30383# Stanford Univ., Calif.
LEGAL ASPECTS OF AIRPORT NOISE AND SONIC BOOM, PART 2
Lillian R. Altree and William F. Baxter Feb. 1968 105 p refs
(Contract FA-67-WA-1675)
(AD-682902) Avail: CFSTI

Topics include: sonic boom production by supersonic airplanes; variations in sonic boom strength; sonic boom effects; legal aspects of sonic boom, including recovery for sonic boom damage. TAB

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N69-29023# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AERODYNAMIC CHARACTERISTICS OF A ONE-CHAMBER PLASMATRON WITH VORTEX GAS STABILIZATION AND ITS EFFECT ON ARC BEHAVIOR
A. D. Lebedev et al Sep. 1968 19 p refs Transl. into ENGLISH from Izv. Sibirsk. Otd. Akad. Nauk SSSR, Ser. Tekhn. Nauk (Novosibirsk), no. 1, 1967 p 53–59
(AD-684663; FTD-MT-24-318-68) Avail: CFSTI CSCL 20/9

This article presents results of an experimental investigation of gas flow in a shell-like inside electrode of a one-chamber plasmatron with vortex gas stabilization of the arc. The experimental investigations with cold blowing were carried out on transparent plastic models and with hot blowing (during burning of the arc) on their metal copies. The transparency of the model made it possible to observe the motion of the gas flows which were visualized by means of stained oil, sand grains, or water jets introduced into the flow at various points over the radius and length by means of a syringe. The aerodynamic effect of a one-chamber plasmatron on arc behavior is primarily evidenced by elongation of the arc after striking in the interelectrode space. TAB

N69-29030# Rensselaer Polytechnic Inst., Troy, N. Y. Div. of Fluid, Chemical and Thermal Processes.
ANALYSIS OF THE EFFECTS OF WALL PERFORATIONS ON THE PERFORMANCE OF A VEHICLE IN A TUBE
Duane E. Cromack Dec. 1968 94 p refs
(Contract C-117-66; Proj. Tubeflight)
(PB-182724; TR-PT-6808) Avail: CFSTI CSCL 13F

The flow induced by a vehicle traveling through a porous-wall tube is analyzed as a one-dimensional incompressible flow steady in the vehicle-fixed frame of reference. The pressure and velocity fields are determined for both nonviscous and viscous flows, for varying vehicle blockage ratios, for externally and internally propelled vehicles, and for various tube-wall porosities. The externally propelled vehicle is represented by a porous drag disc and the results of the investigation show that with this type of propulsion even small wall porosities (of less than 10 per cent) can be effective in reducing the extent of the disturbed flow field and the drag of the vehicle. Author (USGRDR)

N69-29095# North Carolina State Univ., Raleigh. Applied Mathematics Research Group.
TWO LECTURES CONCERNING PRESSURIZED CRACKS
Ian N. Sneddon 28 Feb. 1969 36 p refs
(Grant AF-AFOSR-444-66)
(AD-684547; AFOSR-69-0875TR) Avail: CFSTI CSCL 20/11

The first lecture deals with the problem of determining the distribution of surface stress necessary to maintain or produce a Griffith Crack of a prescribed shape. By use of the theory of Fourier transforms and of the theory of dual integral equations a solution is found in the form which involves two simple integrations. In the second lecture it is shown that the problem of determining the crack energy and the stress intensity factor for a cruciform crack deformed by internal pressure can be reduced to that of solving an infinite system of simultaneous linear algebraic equations. By comparing the numerical values derived by truncating this system with those calculated by Stallybrass it is shown that a remarkably accurate approximation is obtained by replacing the infinite system by some five or six equations. Author (TAB)

N69-29136# Commissariat a l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucleaires.
RELATION BETWEEN THE STRUCTURE OF THE TWO-PHASE LAYER NEAR THE HEATED WALL AND THE MECHANISM OF EXCHANGE [RELATION ENTRE LA STRUCTURE DE LA COUCHE DIPHASIQUE PRES D'UNE PAROI CHAUFFANTE ET LES MECANISMES D'ECHANGES]
R. Semeria [1968] 23 p In FRENCH Presented at Intern. Conf. on Mass and Heat Trasfer in Turbulent Boundary Layer, Hersog Novi, Yugoslavia
(CEA-CONF-1097; CONF-680943-1) Avail: AEC Depository Libraries

The cooling of a heated wall by boiling of a pure liquid is analyzed by considering first the movements of liquid around bubbles being formed and displaced on the wall. From this are deduced the various mechanisms responsible for the excellent thermal exchange between the wall and the boiling liquid so long as the wall remains wet. The evolution of the two-phase structure near the wall was found to be a function of the density of the thermal flux, the mean temperature of the liquid, and the rate of circulation, by analyzing especially the instantaneous local temperature of the fluid given by a microthermocouple. It was found that the definitive drying of a portion of the wall (thermal flux of film boiling) is conditioned not only by the hydrodynamics of the two-phase structure but also by the thermal properties of the wall itself; in particular, the thermal flux of film boiling on the thin walls can be very much less than the critical flux on thick walls. Author (NSA)

N69-29144*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
SUMMARY AND CORRELATION OF SKIN-FRICTION AND HEAT-TRANSFER DATA FOR A HYPERSONIC TURBULENT BOUNDARY LAYER ON SIMPLE SHAPES
Edward J. Hopkins, Morris W. Rubesin, Mamoru Inouye, Earl R. Keener, George C. Mateer et al Thomas E. Polek Washington Jun. 1969 29 p refs
(NASA-TN-D-5089) Avail: CFSTI CSCL 01A

Local skin-friction and heat-transfer data were directly measured in air for turbulent boundary layers on flat plates, cones, and a wind-tunnel wall. The Mach number at the edge of the boundary layer ranged between 5 and 7.4 and the wall to adiabatic wall temperature ratio varied bwtween 0.1 and 0.6. The skin-friction and heat-transfer data are compared with other data obtained by direct measurement of surface shear with balances and accompanied by boundary layer surveys. The use of momentum thickness Reynolds number in the skin-friction comparison avoids arbitrary location of the virtual origin of the turbulent boundary layer. Adiabatic and cold wall data are employed to assess four theories for predicting turbulent skin friction. Analysis of the skin-friction data indicates that the theory of Van Driest II or Coles gives the best predictions for wall to adiabatic wall temperature ratios above 0.3. At wall to adiabatic wall temperature ratios below 0.3, none of the theories give the proper trend with wall to adiabatic wall temperature ratio. The heat-transfer analysis for nonadiabatic conditions generally substantiates the skin-friction analysis. Author

N69-29152 Northwestern Univ., Evanston, Ill.
SPREADING OF A GAS STREAM IN AIR-WATER CONCURRENT BUBBLY FLOW
Richard Frederich Sutton, Jr., (Ph.D. Thesis) 1968 188 p
Avail: Univ. Microfilms: HC $8.60/Microfilm $3.00 Order No. 69-1955

An experimental investigation was made of the motion of a gas stream in a vertical, upward air-water bubble flow at atmospheric pressure in a 2 in. diameter pipe. An axial, co-current air jet issuing at the same velocity as the secondary flow was used for the gas stream. The superficial liquid velocity in the pipe varied between 1.5 and 3.4 ft/sec, and the cross-sectional average void fraction varied between 0% and 6%. Local void fractions were measured by means of an improved resistivity probe with a maximum cross-sectional average void fraction error of 4%. Void fraction and velocity profiles were measured in the absence of the jet. Now turbulent flow two-phase continuity equations were derived and solved to explain the profiles in the region of similarity. Two-phase bubble diffusivities were less than single-phase mass diffusivities at the same Reynolds number; they were a function of axial coordinate and increased with increasing velocity or average void fraction. Dissert. Abstr.

N69-29160 Oregon State Univ., Corvallis.
GAS ABSORPTION BY ENTRAINMENT FROM A PLUNGING LIQUID JET
Gerald Eugene Swiggett (Ph.D. Thesis) 1969 111 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-463

The chemical system of carbon dioxide and water was chosen to study the effects of jet diameter, jet Reynolds number, jet Weber number, jet length, and liquid pool depth. An equation was developed to predict the concentration of dissolved carbon dioxide in the liquid pool. Jet diameters of 0.00775 feet to 0.0233 feet were studied. It was found that the amount of carbon dioxide absorbed in the pool increased as the jet diameter decreased. Jet Reynolds numbers of 7,000 to 11,000 and Weber numbers of 103 to 614 were investigated. This range allowed the study of both limited entrainment and larger amounts of entrainment. The concentration of dissolved gas was found to increase for any given jet diameter as the jet Reynolds number and Weber numer increased. Jet lengths of one to five inches and pool depths of three to eight inches were analyzed. The concentration of absorbed gas increased as the pool depth or pool volume decreased. The concentration of dissolved gas in the liquid pool was found to be uniform throughout the pool at any given time for all jet systems studied. Dissert. Abstr.

N69-29164*# Techtran Corp., Glen Burnie, Md.
MEASUREMENTS OF THE PRESSURE COEFFICIENTS OF PITOT TUBES IN SUPERSONIC FLOWS
S. P. Perov Washington NASA Jun. 1969 5 p refs Transl. into ENGLISH from Tr. Tsentr. Aerolog. Observ. (Moscow), no. 77, 1967 p 30-32
(Contract NASw-1695)
(NASA-TT-F-11943) Avail: CFSTI CSCL 20D

Experiments involving pitot tubes in a supersonic stream of rarified gases were carried out. Tubes were utilized with 10.5 and 1 mm apertures. Parameters measured during the experiments included air pressure and temperature in the receiver and pressure in the measuring chamber. Factors considered included Reynolds and Mach numbers, and the shape of the tube. The relationship between measured values and values involving Rayleigh functions are discussed. Author

N69-29170 California Inst. of Tech., Pasadena.
ELECTRON BEAM MEASUREMENTS OF DENSITY IN SHOCK WAVES REFLECTING FROM A COLD WALL
Hugo de Oliveira Piva (Ph.D. Thesis) 1968 89 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 69-629

The density distribution of a normal shock wave in argon is measured during its reflection from a heat-conducting wall using an electron beam densitometer in the GALCIT 17-in diameter shock tube at incident Mach numbers 8.00, 4.00 and 2.96. The results presented here give both quantitative and qualitative

information about the interaction of the incident shock wave with the wall, the effects of the wall heat transfer and accommodation on the density near the wall, the formation of the reflected shock wave, its strength and trajectory on the x-t diagram, and the nature of the flow field lying between the thermal layer and the reflected shock wave at large times. Dissert. Abstr.

N69-29186# Boeing Co., Seattle, Wash. Office of International Operations.

FLOW WITH SIMULTANEOUS NATURAL AND FORCED CONVECTION

R. Zh. Zeytounian Mar. 1969 15 p refs Transl. into ENGLISH from French Report No. ONERA-TP-663 (ONERA-TP-663; B-887) Avail: CFSTI

The flow around an obstacle whose wall is submitted to a given thermal field is presented. The perturbation of the hydrodynamic elements originated by the obstacle are the result of the coupling between a natural convection and a forced convection. The flow takes place within a layer of given height. In the linear approximation, the perturbations are superposed to a known basic flow. The coupling of the two convections leads to the establishment downstream of the obstacle of a periodic process; this undulating movement is the result of the interaction between the thermal boundary layer and the free stream. Author

N69-29187# Boeing Co., Seattle, Wash. Office of International Operations.

ANALOGUE DETERMINATION OF AIR FOIL PROFILES IN THE TRANSONIC RANGE

F. Rigaut Jan. 1969 36 p refs Transl. into ENGLISH from French Presented at meeting of the Fluid Mech. Group of AGARD on Transonic Aerodynamics, Paris, 18-20 Sep. 1968 (B-855) Avail: CFSTI

An analog calculation method based on finite difference utilization is applied to determination of transonic flow from hodographs. After a brief description of analog and hybrid methods, special attention is given to study of the profiles. Cases of symmetrical, zero lift and lifting profiles are dealt with in succession. Examples and comparisons are given to outline the possibilities of the method, and a calculation algorithm is proposed to determine by hybrid technique a flow containing a shock wave. This method can also be used in the calculation of cascades and different possibilities and examples are made available. Author

N69-29191*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.

FLOW IN A MODEL OF THE HUMAN AORTA

Claus Timm Washington NASA May 1969 25 p refs Transl. into ENGLISH from Z. Biol. (Munich), v. 101, 1942 p 79-99 (Contract NASw-1692) (NASA-TT-F-12109) Avail: CFSTI CSCL 20D

The anatomical form of the human aorta and its stream path were investigated for effects on fluid flow. Two glass models of natural dimensions and a simplified, flattened-out model were perfused with water and dye to demonstrate laminar, turbulent, and/or transitory flow. Flow velocities were altered by pressuring the rubber outlet below the aorta. Flow characteristics are illustrated by photographs. The critical velocity was determined at 9 cm/sec. A retrograde eddy and double eddy in the Sinus of Valsalva were demonstrated in both models. Comparisons were made between the human aortic form and the natural model in the reproducibility of flow patterns and velocities. M.H.E.

N69-29194 Rensselaer Polytechnic Inst., Troy, N.Y.

NUMERICAL SOLUTIONS OF THE COMPRESSIBLE BOUNDARY LAYER EQUATIONS FOR ROTATING AXISYMMETRIC FLOWS

Olof Lennart Anderson (Ph.D. Thesis) 1967 177 p Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 67-12825

Numerical solutions are presented for the incompressible and the compressible boundary layer equations which describe the flow produced by rotating axisymmetric free-stream flows near a stationary wall normal to the axis of symmetry. Two limiting cases of incompressible flow are considered: first, the boundary layer produced by an irrotational vortex with zero free-stream vorticity, and second, the boundary layer produced by solid-body rotation with constant free-stream vorticity. First-order numerical solutions of the compressible boundary layer equations for small Mach numbers are also presented for the two rotating flow conditions with different free-stream static temperature distributions. These cases correspond to constant free-stream static temperature and constant free-stream stagnation temperature. Dissert. Abstr.

N69-29211# Colorado State Univ., Fort Collins. Engineering Research Center.

HOT-WIRE ANEMOMETER MEASUREMENTS IN LARGE-SCALE BOUNDARY LAYERS

V. A. Sandborn *In* Md. Univ. Advan. in Hot-Wire Anemometry Jul. 1968 p 102-119 refs Sponsored by the army (See N69-29201 16-14) Avail: CFSTI

Experimental studies of the operation of hot-wire anemometers in turbulent shear flow are reported in connection with a program to simulate layers in the laboratory wind tunnel. A detailed evaluation of the normal turbulent velocity from yawed wire measurements is presented. Present theory of yawed wires leads to an uncertainty of approximately 20% in the turbulent velocity measurements. The operation of a hot wire in a velocity-temperature field is also considered, and it is demonstrated that a pure velocity signal cannot be obtained from a hot wire in the presence of temperature fluctuations. Author

N69-29214# Purdue Univ., Lafayette, Ind. School of Civil Engineering.

TURBULENCE MEASUREMENT IN LIQUIDS: SOME CONSIDERATIONS AND EXPERIENCES REGARDING OPTIMIZATION

J. W. Delleur, G. H. Toebes, and C. L. Liu (Tenn. Technol. Univ.) *In* Md. Univ. Advan. in Hot-Wire Anemometry Jul. 1968 p 153-166 refs (See N69-29201 16-14) (Contract Nonr-1100(25)) Avail: CFSTI

The parameters for optimization of velocity sensitivity with respect to temperature sensitivity were derived from an equation describing the steady-state heat transfer from a long circular cylinder held perpendicular to the flow. The temperature coefficient of electric resistivity of the sensor and the fluid viscosity were found to be the governing physical properties. Anemometer stability required that the ambient temperature and the amount of dissolved gases be kept constant. Dust and dissolved mineral contamination should be eliminated particularly for work with bare metal sensors. Quartz covered cylindrical film sensors were found useful in electricially conducting fluids and where contamination was difficult to control. It was also discovered that Hytemco wire sensors are versatile and less expensive for use in filtered de-ionized water. Methods of checking the instrument frequency response are discussed briefly. Author

N69-29223# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ACOUSTIC EMISSION OF CAVITIES IN SUPERSONIC AIRFLOW
M. G. Morozov Oct. 1968 16 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Otd. Tekhn. Nauk, Mekhan. i Mashinostr. (Moscow), no. 2, 1960 p 40–46
(AD-684662; FTD-MT-24-296-68) Avail: CFSTI CSCL 20/1

The work gives the results of an experimental investigation of acoustic emission of cavities of diverse configuration on a flat plate in a supersonic streamline flow of air at M = 1.7. From the investigation it is concluded that travelling waves on the interface result from the appearance of natural oscillations in a system consisting of the interface and the volume of air in the depression. Author (TAB)

N69-29229*# Techtran Corp., Glen Burnie, Md.
EFFECTS OF CURVATURE ON THE SIMILARITY STRUCTURE AND TURBULENT MIXING OF TWO-DIMENSIONAL CURVED JETS
Hiroshi Endo Washington NASA Jun. 1969 29 p refs Transl. into ENGLISH of Japanese Report NAL-TR-156
(Contract NASw-1695)
(NASA-TT-F-12274; NAL-TR-156) Avail: CFSTI CSCL 20D

A mass flow exists across the jet centerline and compensates for the effect of the different rates of entrainment at the two edges of the curved jet. The flow eventually preserves the nearly symmetric profile of flow velocity. The turbulent structure of the jet is self-preserving except in the initial mixing region, where turbulence is rapidly growing and is not in equilibrium. On the basis of dynamic similarity thus established, the similar solution of Reynolds' equations of motion for two-dimensional curved jets is derived with the use of Sawyer's expression for the turbulent shear stress. The formula relating the curvature factor C to the parameters of the velocity at the jet centerline is derived. The conclusions of the theoretical analysis are examined in the light of the experimental results. As a result, it is reasoned that C takes a large value (possible more than 10) in the initial mixing region, and seems to tend towards a final value of 3 in the equilibrium region. Author

N69-29235*# Techtran Corp., Glen Burnie, Md.
HIGH-VELOCITY HYDRODYNAMICS, NO. 4
I. L. Rozovskiy, ed. Washington NASA Jun. 1969 165 p refs Transl. into ENGLISH of the publ. "Gidrodinamika Bolshikh Skorostey" Kiev, Naukova Dumka Press, 1968
(Contract NASw-1695)
(NASA-TT-F-577) Avail: CFSTI CSCL 12A

The problem of complete approximation in some region of the Euclidian space of a new boundary value problem is discussed. The criteria for a uniform approximation are satisfied by allowing freedom in the selection of the mapping of the Euclidian space into the new space as well as in the choice of the new differential operator, the boundaries of the region and the boundary conditions. The complete approximation in the new space yields a linear problem which leads to satisfactory results in physical space for sufficiently large perturbation parameters. The Poincare–Lighthill–Go method is an example of a procedure based on the idea of complete approximation. Problems in hydrodynamics which may be solved by this method are examined. Author

N69-29241 Washington Univ., St. Louis, Mo.
DETERMINATION OF AEROSOL SIZE AND VELOCITY BY HOLOGRAPHY AND STEAM-WATER CRITICAL FLOW
John Howard Matkin (Ph.D. Thesis) 1968 169 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 69-1198

An experimental technique for determining the particle size and velocity for liquid or solid aerosols transported by air flow is described. The technique leaves the flow undisturbed and is applicable over a large range of particle sizes and velocities. The combination of a Q-spoiled ruby laser and single-beam holography was used to record the desired information. The holograms were illuminated with a helium–neon laser to reconstruct the magnified images, which were analyzed with closed circuit television. The technique was applied to several flows including an air jet in which the particle size and velocity components were determined. Dissert. Abstr.

N69-29246 Kansas State Univ., Manhattan.
NATURAL CONVECTION IN SHORT TUBES AT HIGH REYNOLD'S NUMBERS, OUTSIDE THE BOUNDARY LAYER
Gangadhara Swami Mathad (Ph.D. Thesis) 1968 84 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-17520

While it is generally true that free convection predominates at low flow velocities, free convection currents, nevertheless, exist even under turbulent conditions. It is only when the effect of these currents is negligible that the natural convection term may be dropped from any heat transfer correlation. The present work showed that natural convection effects should not be neglected for turbulent flow of water in short horizontal tubes. In fact, the groups characterizing natural convection were as significant as those characterizing forced convection. In addition to the usual practice of studying the importance of Grashof number, which is characteristic of natural convection, this was broken up into two dimensionless groups, the Galileo number and the Gay Lussac number, and the effects of these were also studied. Dissert. Abstr.

N69-29258 Johns Hopkins Univ., Baltimore, Md.
THE INTERMITTENT REGION OF A TURBULENT BOUNDARY LAYER
Valdis Kibens (Ph.D. Thesis) 1968 142 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-16436

A turbulence detector circuit was developed whose output was a random square wave, equal to 1 for turbulent flow and 0 for nonturbulent flow. A continuous signal corresponding to any measurable flow property was conditionally sampled, and ensemble averages were taken in real time. Two types of general averages were taken: zone averages and point averages. Both types of averages were taken of the mean streamwise velocity, the normal velocity, fluctuation intensity, and of the span-wise vorticity component. The distribution of properties across the interface was largely independent of the position in the boundary layer at which the interface was examined. Point averages of the fluctuation level exhibited a smooth variation across the interface, but a rapid change was observed in the point average of the vorticity across the interface at all intermittency levels. Measurements in the nonturbulent regions showed that the large scale motion associated with the interface is potential and may be represented by a potential flow over a wavy surface. Dissert. Abstr.

N69-29273*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
INTERPRETATION OF TURBULENCE MEASUREMENTS [INTERPRETATION DES MESURES DE TURBULENCE]
Robert Legendre Washington NASA May 1969 19 p Transl. into ENGLISH from French rept. ONERA-TN-138
(Contract NASw-1692)
(NASA-TT-F-12241; ONERA-NT-128) Avail: CFSTI CSCL 20D

The interest of a complete observation in water at low speed is first pointed out; then the mechanism of formation of viscous vortices in a flow is outlined. This justifies the successive

studies of isolated vortices, of vortex streets, and of multiple vortex streets. It is shown that, due to such an analysis, the hot-wire measurements can be analyzed without questioning Taylor's assumption. Lastly, entropy turbulence and the creation of sound waves are briefly reviewed. Author

N69-29276 Stanford Univ., Calif.
STUDY OF A DIRECTIONAL-MEAN-FREE-PATH METHOD FOR GAS FLOW IN TRANSLATIONAL NONEQUILIBRIUM
Elmer Dale Martin (Ph.D. Thesis) 1968 167 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 69-260

A new theoretical approach for the description of gas flows having strong deviations from local translational equilibrium when the Navier-Stokes equations become invalid, is presented. The usual approach in dealing with the limitations in the macroscopic description is to consider the kinetic level of description, governed by the Boltzmann equation, and perhaps to relate a kinetic analysis to higher approximations in the macroscopic level, by the Chapman-Enskog procedure. Because of the general intractability of the Boltzmann equation or models of it, and the limitation of the Chapman-Enskog theory to near-local-equilibrium flows, the present approach considers the development and possible utility of a directional level of description. Dissert. Abstr.

N69-29293 Delaware Univ. Newark.
TURBULENCE PHENOMENA IN DRAG REDUCING SYSTEMS
Frederick Allen Sayer (Ph. D. Thesis) 1968 268 p
Avail: Univ. Microfilms: HC $12.15/Microfilm $3.50 Order No. 68-17951

Local time average velocities and axial and radial turbulence intensities for two concentrations of a drag reducing fluid were determined using a photographic technique. The 0.01% and 0.1% concentrations used in this work are typical of the two distinct types of drag reduction that are observed: drag reduction occurring at a critical Reynolds number below which Newtonian behavior prevails, and drag reduction at all Reynolds numbers in excess of 2100. For each of the solutions the velocity and intensity profiles were determined at five locations within the tube and at two values of the Reynolds number. Data were obtained for Newtonian fluids at two Reynolds numbers. A dimensional analysis incorporating the fluid relaxation time as a governing parameter is used to formulate the similarity laws for drag reducing systems. Design calculations, for a 12 inch diameter tube, indicate that significant drag reduction may not be attainable under conditions of practical interest. Dissert. Abstr.

N69-29294# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Atomnoi Energii.
RESONANCE PHENOMENA IN PLASMA AND FLUID FLOW
A. V. Timofeev 1968 146 p refs In RUSSIAN
(IAE-1570) Avail: AEC Depository Libraries

It was found that stability and oscillations of plasma and ordinary fluid flow are determined by the phenomena developing in resonance points in which the phase wave velocity coincides with the rate of flow. It is shown that in a simple plasma with sufficiently high rate of flow, all undamped intrinsic oscillations are absent. A similar assertion can be found in the Rayleigh theorem for plane-parallel incompressible fluid flow. NSA

N69-29308 Stanford Univ., Calif.
ASYMPTOTIC STRUCTURE OF SOLUTIONS OF THE STATIONARY NAVIER-STOKES EQUATIONS IN AN EXTERIOR DOMAIN
David Charles Clark (Ph.D. Thesis) 1968 67 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 68-15038

Under consideration is the asymptotic structure of solutions of the stationary Navier-Stokes equations for viscous, incompressible flow in a neighborhood of infinity. The solution vector is assumed to approach a non-zero limit at infinity. The region is assumed to be three dimensional, although the same methods apply to the two dimensional case. Use is made of integral representations of solutions as in potential theory. When the integral over the inner bounding surface of stress plus momentum flux vanishes, the difference between the velocity and the velocity at infinity vanishes more rapidly than otherwise. It is shown that this difference may vanish at infinity to any given algebraic order, and that it may be written as the sum of a solution of the Oseen equations plus a remainder term of small order. The other results are concerned with the curl of the velocity field, called the vorticity. Dissert. Abstr.

N69-29320 Stanford Univ., Calif.
VISCOUS, HYPERSONIC FLOW AROUND A BLUNT BODY
John Edward Kaiser, Jr. (Ph.D. Thesis) 1968 174 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 68-15062

The hypersonic flow of a viscous fluid around a blunt body is examined for low-density flow conditions. The basis of this study is a simplified form of the Navier-Stokes equations, modified by slip and temperature-jump conditions at the flow boundaries. These simplified equations are valid in the same flow regime as are the second-order boundary-layer equations, but are uniformly applicable through the entire shock layer. Thus the shock-layer flows studied are those in which the viscous layer is too thick to be treated by classical boundary-layer theory and in which the effects of a thickened shock are not appreciable. The flow is taken to be either plane symmetric or axisymmetric. In addition, for convenience in the computational procedures, a perfect gas with constant specific heats is assumed. Two methods of solution are investigated. The method of series truncation is used to obtain solutions in the neighborhood of the axis of symmetry, and several implicit finite-difference schemes are examined for use in obtaining solutions downstream of the axis. Dissert Abstr.

N69-29352 New York Univ., N.Y.
BUBBLE GROWTH BY COALESCENCE IN GAS FLUIDIZED BEDS
Dimitris T. Argyriou (Ph.D. Thesis) 1968 239 p
Avail: Univ. Microfilms: HC $13.50/Microfilm $3.85 Order No. 68-15925

Bubble size and distribution of bubble sizes were studied in an air fluidized bed 11-1/2 inches in diameter and 3 feet high. Motion pictures were taken of the bubbles breaking the top surface of the bed and the size of the bubbles determined from the film. The distribution of bubble volumes at a given bed height was expressed as a gamma distribution with parameters obtained from the observations. A statistical mechanical method previously proposed for studies in agglomeration of particles was used in the mathematical formulation of the problem. A mechanism defining the rate of bubble coalescence was established. According to this mechanism collisions are binary and the rate of collisions of two species is proportional to the product of the number densities of the colliding species and their average projected area. A one parameter model based on this mechanism yielded an equation describing the evolution of the distribution with bed height. Dissert. Abstr.

N69-29388 Stanford Univ., Calif.
PITOT-PRESSURE MEASUREMENTS WITH RAPIDLY TRAVERSING PROBES IN THE WAKE OF A SPHERE IN A DIVERGING HYPERVELOCITY STREAM

Denis Wai-man Tsao (Ph.D. Thesis) 1968 166 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 69-307

Pitot-pressure measurements were made with spring-driven traversing probes in the wake of a 2-inch-diameter sphere. The experiments were conducted in the nitrogen stream of a spark-heated wind tunnel at Mach number 15 to 17. The primary test parameter considered was the Reynolds number, based on free-stream conditions and sphere diameter. The three basic values used were (approximately) 20,000, 80,000 and 200,000. The stagnation temperature ranged from about 1,250° to about 3,750°K. The region of the wake that was probed extended from 3 to 15 sphere diameters downstream from the nose of the sphere. Two spring-driven traversing probes were used. An axially traversing probe, with a speed of 35 fps, carried a pitot-pressure rake which had a longitudinal sweep of 9 inches. The second probe made vertical traverses at 60 fps over an 8-inch path across the wake.
Dissert. Abstr.

N69-28383 Delaware Univ., Newark.
A STUDY OF THE MAGNETOGASDYNAMIC EQUATIONS AS APPLIED TO SHOCK AND BLAST WAVES
Jeffrey Alan Friedhoffer (Ph.D. Thesis) 1968 128 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 68-15536

This dissertation examines the one-dimensional, planar, Navier-Stokes equations as applied to magnetogasdynamic shock waves and also gas dynamic blast waves. The magnetogasdynamic shock waves are studied under the assumption that the coefficients of viscosity, thermal and electrical conductivity are independent of temperature. The viscosity is assumed to be dependent on the gradient of velocity in a non-Newtonian, power law manner. The phase space of the shock equations is analyzed and these equations are numerically integrated through the shock. The dependence of the thickness of the shock on the phenomenological parameters, the downstream magnetic field, the non-Newtonian parameter and the downstream Mach number are also examined.
Dissert. Abstr.

N69-28381 California Inst. of Tech., Pasadena.
THE EFFECT OF DROPLET SOLIDIFICATION UPON TWO-PHASE FLOW IN A ROCKET NOZZLE. A KINETIC THEORY INVESTIGATION OF SOME CONDENSATION-EVAPORATION PHENOMENA BY A MOMENT METHOD
Pattamadai Narasimhan Shanker (Ph.D. Thesis) 1968 153 p
Avail: Univ. Microfilms: HC $8.80/Microfilm $3.00 Order No. 69-535

It is shown that under certain conditions an equilibrium flow exists, where the gas and particle phases have the same velocity and temperature at each section of the nozzle. The flow is divided into three regions: the first region, where the particles are all in the form of liquid droplets; a second region, over which the droplets solidify at constant freezing temperature; and a third region, where the particles are all solid. A solution is obtained for small particle slip velocities using the Stokes drag law and the corresponding approximation for heat transfer between the particle and gas phases. When a liquid surface, in contact with only its pure vapor, is not in thermodynamic equilibrium with it, a net condensation or evaporation of fluid occurs. This phenomenon is studied from a kinetic theory viewpoint by means of the moment method. The evaporation–condensation rate is calculated for a spherical droplet and for a liquid sheet, when the temperatures and pressures are not too far removed from their equilibrium values.
Dissert. Abstr.

N69-29416 Minnesota Univ., Minneapolis.
RECOIL PHENOMENA IN VISCOELASTIC FLUIDS
James Watkins Kelb (Ph.D. Thesis) 1968 166 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 68-17689

Simple constitutive equations for the description of viscoelastic fluids can be applied in practical engineering calculations if appropriate conditions for their use are satisfied. Viscoelastic fluids exhibit a complex range of behavior. A complete mathematical description of such materials would require a complex expression containing a multitude of material constants. In any particular situation only a part of the range of behavior is elicited. Hence, a constitutive equation describing this partial response could be quite simple. This expression should apply whenever a similar partial response is evoked. A test of this thesis is made by determining the material constants in simple constitutive equations for various fluids by measuring their harmonic response when subjected to a sinusoidal pressure gradient and applying the derived material constants to predict the displacement of the fluid in recoil experiments.
Dissert. Abstr.

N69-29431 John Hopkins Univ., Baltimore, Md.
RAPID ACCELERATION OF HIGH INTENSITY TURBULENT SHEAR FLOW
Kenneth Stanley Kaye (Ph.D. Thesis) 1968 133 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 68-18433

An experimental study was made of the energy relations holding in the "central core" of a high intensity turbulent shear flow subject to rapid strain rates in order to explore the possibility of kinetic energy transfer from the random fluctuations of the turbulence into directed kinetic energy of the mean motion. A preliminary investigation was conducted to examine the response of total pressure probes in turbulent flow. The flow of high-intensity turbulent fluid through a moderate contraction providing rapid rates of strain was the main subject of the study. Velocity and pressure measurements were made across the "central core" flow by using a rotating straight hot-wire and total pressure probe in order to study energy variations through the contraction. In the "central core," total turbulent kinetic energy was found to increase along all mean streamlines, corresponding to a loss in total pressure.
Dissert. Abstr.

N69-29473# Brown Engineering Co., Inc., Huntsville, Ala. Advanced Systems and Technologies Group.
INVESTIGATION OF TWO-DIMENSIONAL FLOW MEASUREMENTS USING THE LASER DOPPLER TECHNIQUE
R. D. Lewis, N. E. Chatterton, and H. J. Watson Dec 1968 129 p refs
(Contract N00014-68-C-0247)
(AD-685249; TN-AST-285) Avail: CFSTI CSCL 20/4

Specification of flow parameters in a moving fluid usually requires knowledge of velocity components in more than one dimension. Using the laser Doppler technique, velocity components may be measured with a great number of geometries. This study investigated combinations of geometries useful for constructing a two-dimensional velocimeter. Three systems underwent extensive study: two incident beam forward scatter, single incident beam forward scatter, and single incident beam forward and backward scatter. System parameters investigated experimentally and theoretically included cross-talk between beam polarization effects, relative scattering intensities, and measurement point constraints. Turbulent flow in a 4-inch-diameter pipe was used to demonstrate the measurement technique utilizing the single beam forward scatter system. Coordinate transformations between velocimeter coordinates and flow system coordinates were derived.
Author (TAB)

N69-29458# Cornell Aeronautical Lab., Inc., Buffalo, N.Y.
A MATHEMATICAL ANALYSIS OF HYDROPLANING PHENOMENA Final Report
H. Daughaday and C. Tung Jan. 1969 154 p
(Contract FH-11-6659)
(PB-182633; CAL-AG-2495-S-1) Avail: CFSTI CSCL 13F

A mathematical analysis is developed for predicting phenomena encountered when a tire rolls or skids on a pavement covered with water film. Partial hydroplaning is considered where part of the normal force on the tire is carried by dry contact between the tire and the pavement and also the onset of total hydroplaning where the tire first becomes entirely supported by hydrodynamic pressures. The flow is divided into a footprint region, an inlet region forward of the footprint region where the gap between the tire and the pavement is comparatively large, and an exterior flow region. A perturbation analysis is used assuming the flow is primarily viscous in the footprint region and primarily inviscid in the inlet region. Pressures in the exterior flow region are taken equal to atmospheric pressure. The solutions for the separate regions are matched together at their boundaries. Author (USGRDR)

N69-29538# New York Univ., N.Y. Dept. of Aeronautics and Astronautics.
NUMERICAL SOLUTION OF THE TURBULENT BOUNDARY LAYER
Lawrence W. Carr and Herbert Fox Wright-Patterson AFB, Ohio ARL Dec. 1968 58 p refs
(Contract F33-615-68-C-1184)
(AD-685240; NYU-AA-68-23; ARL-68-0215) Avail: CFSTI CSCL 20/4

An implicit finite difference method is presented for the solution of problems of incompressible and compressible turbulent boundary layer flows using the phenomenological boundary layer equations in the physical plane. The turbulent motion is represented by an eddy viscosity; the method permits an arbitrary choice of the model to be used and is thus proposed as an analytical tool for the comparative study of phenomenological turbulence. Since the major changes in the flow variables occur near the wall boundary in turbulent flow, the numerical procedure incorporates a variable-step-size-differentiation in all y direction calculations so that greater accuracy can be obtained in these regions without excessive computational complexity. The relation between step sizes is arbitrary to allow the introduction of experimental data as input to the analysis. The procedure presented is recommended for analysis of turbulent flows influenced by pressure gradients or strong variations in the boundary conditions, e.g., normal or tangential injection. The incompressible flow test cases which were studied include normal injection and adverse pressure gradient. In addition, two viscosity models were studied for flat plate flow. Author (TAB)

N69-29573*# National Aeronautics and Space Administration, Washington, D.C.
CONTRIBUTION TO THE STUDY OF THE THREE-DIMENSIONAL INCOMPRESSIBLE LAMINAR BOUNDARY LAYER IN THE NONSTATIONARY REGIME [CONTRIBUTION A L'ETUDE DE LA COUCHE LIMITE TRIDIMENSIONNELLE LAMINAIRE INCOMPRESSIBLE EN REGIME INSTATIONNAIRE]
R. Zh. Zeytounian May 1968 58 p refs Transl. into ENGLISH of ONERA Report ONERA-NT-131
(NASA-TT-F-12250) Avail: CFSTI CSCL 20D

The problems of nonstationary incompressible laminar boundary layers developing from a standstill are reduced to the same formal scheme by stating the problem from a general viewpoint, making it possible to cover the particular cases studied previously. In this way we are lead to suppose that the velocity of the external flow can be expanded into a series in $\sqrt{t}$. It is then shown that the different quantities characterizing the flow in the unsteady boundary layer can be determined in the form of a power series expansion in $\sqrt{t}$. A simple application is given for the case of a circular cylinder. Author

N69-29578# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
THE TURBULENT, BOUNDED WALL-JET: A SOLUTION TO THE LINEARIZED EQUATIONS Final Report
Ronald L. Haugen and John W. Steurer Nov. 1968 41 p refs
(AD-684704; ARL-68-0204) Avail: CFSTI CSCL 20/4

The linearizing technique is applied to the turbulent, variable pressure flows in a wall-jet ejector. The existence of a pressure gradient necessitates a coordinate transformation into the von Mises plane where a closed form solution to the linearized equation is obtained. Author (TAB)

N69-29597 Tennessee Univ., Knoxville.
COMPARISON OF A FIRST-ORDER TREATMENT OF HIGH-ORDER BOUNDARY-LAYER EFFECTS WITH SECOND-ORDER THEORY AND EXPERIMENTAL DATA
Clark Houston Lewis (Ph.D. Thesis) 1968 154 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 69-1249

The axisymmetric nonsimilar compressible laminar boundary layer equations including approximate transverse curvature terms were modified to treat inviscid external vorticity, slip, and temperature jump as first order quantities. The effects of boundary layer displacement were also treated. Primary interest was in predicting experimentally measurable quantities over the entire body length of nonanalytic shapes, and the analysis was not confined to the nose or stagnation region. A review is included of second order boundary layer theory and of recent developments in the numerical solution of second order boundary layer effects. Comparisons of predicted displacement-induced pressure distributions, heat transfer distributions and zero lift drag were made with results from second order boundary layer theory and experimental data for a spherically blunted 9-degree half-angle cone at free stream Mach numbers of 9 and 19. Dissert. Abstr.

N69-29608*# National Aeronautics and Space Administration, Langley Research Center, Langley Station, Va.
HEAT TRANSFER TO THE WINDWARD SIDE OF A FINENESS-RATIO-2.9 CYLINDER WITH NEARLY SPHERICAL ENDS AT A MACH NUMBER OF 6 AND ANGLES OF ATTACK OF 50°, 70°, AND 90°
James L. Hunt Washington Jul. 1969 45 p refs
(NASA-TN-D-5251) Avail: CFSTI CSCL 20D

An investigation was conducted in the Langley 20-inch Mach 6 tunnel to define the heat transfer to a fineness-ratio-2.9 cylinder with nearly spherical ends. Heat transfer data and schlieren photographs were obtained at a nominal Reynolds number, based on model diameter, of 1×10^6 at sweep angles of 0°, 20°, and 40°. Beckwith's laminar swept infinite-cylinder theory, small-cross-flow theory, and local similarity theory with Libby's three-dimensional stagnation-point theory were used piecewise to predict the laminar heat transfer with acceptable accuracy. Local flat-plate approximations for turbulent heat transfer, calculated by the method of Spalding and Chi, agreed with the data obtained in the turbulent flow regions. Author

N69-29636# Naval Ship Research and Development Center, Washington, D.C. Hydromechanics Lab.
ITERATIVE METHOD FOR THE LAMINAR BOUNDARY LAYER WITH PRESSURE GRADIENT AND SUCTION OR BLOWING Final Report

Paul S. Granville Nov. 1968 27 p refs
(AD-685158; NSRDC-2946) Avail: CFSTI CSCL 20/4

The laminar boundary layer equations with pressure gradient and with suction or blowing are approximately solved analytically by an iteration method. The resulting velocity profile provides criteria for separation and stability as a function of pressure gradient and suction or blowing. This method is simpler and more versatile as well as more accurate than the classical Karman-Pohlhausen method. Author (TAB)

N69-29643*# Tennessee Univ., Knoxville. Dept. of Mechanical and Aerospace Engineering.
FUNDAMENTAL STUDY IN LOW-DENSITY GAS DYNAMICS Progress Report, 1 Nov. 1968 – 30 Jun. 1969
M. W. Milligan and H. J. Wilkerson 30 Jun. 1969 29 p refs
(Grant NGR-43-001-023)
(NASA-CR-101643; AE-69-023-5) Avail: CFSTI CSCL 20D

This report outlines progress in a theoretical and experimental investigation of rarefied-gas viscoseals. A theoretical analysis has been developed by applying non-continuum boundary conditions to the Reynolds lubrication equations. Comparisons between the performance predicted by this model and the experimental data of several investigators are presented. The experimental work is briefly mentioned; it is concerned with the performance of the viscoseal in the gas flow regime between continuum and free molecular and over a wide speed range up to 30,000 rpm. K.W.

N69-29647*# North American Aviation, Inc., Downey, Calif. Space and Information Systems Div.
INVESTIGATION TO DEFINE THE PROPAGATION CHARACTERISTICS OF A FINITE AMPLITUDE ACOUSTIC PRESSURE WAVE Final Report
A. C. Peter and J. W. Cottrell 11 Oct. 1968 99 p refs
(Contract NAS8-11441)
(NASA-CR-98494; SID-66-1441) Avail: CFSTI CSCL 20D

The contribution of high entropy production regions to the generation characteristics of a finite amplitude pressure wave is considered. The analysis results in a nonlinear convected wave equation in terms of entropy and a thermodynamic J-function. It is shown that the equation reduces to the classical form when isentropy is assumed. An acoustical model for nonisentropic noise radiation is derived and comparisons with experiment made. Author

N69-29661 California Inst. of Tech., Pasadena
NEARLY FREE MOLECULAR HEAT TRANSFER FROM A SPHERE
Robert Jay Schmulian (Ph. D. Thesis) 1968 82 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 69-533

Consider a sphere immersed in a rarefied monatomic gas with zero mean flow. The distribution function of the molecules at infinity is chosen to be a Maxwellian. The boundary condition at the body is diffuse reflection with perfect accommodation to the surface temperature. The microscopic flow of particles about the sphere is modeled kinetically by the Boltzmann equation with the Krook collision term. Appropriate normalizations in the near and far fields lead to a perturbation solution of the problem, expanded in terms of the ratio of body diameter to mean free path (inverse Knudsen number). The distribution function is found directly in each region, and intermediate matching is demonstrated. The heat transfer from the sphere is then calculated as an integral over this distribution function in the inner region. Final results indicate that the heat transfer may at first increase over its free flow value before falling to the continuum level. Dissert. Abstr.

N69-29681*# Virginia Polytechnic Inst., Blacksburg. Dept. of Mechanical Engineering.
ANALYTICAL INVESTIGATION OF SIDE JET SUPERSONIC STREAM INTERACTION INCLUDING VORTEX FLOW IN ROCKET NOZZLES FOR THRUST VECTOR CONTROL
W. G. Wilson and R. A. Comparin Jun. 1969 87 p refs
(Grant NGR-47-004-030)
(NASA-CR-66754) Avail: CFSTI CSCL 20D

The flow disturbances in a supersonic rocket nozzle due to secondary injection were analyzed by use of an effective body approximation. The analysis is based upon a consideration of the momentum flux of the primary and secondary flows and the underexpansion of the secondary jet. The analysis shows that two characteristic dimensions of the effective body are required to describe a particular flow condition. The two characteristic dimensions, termed expansion width and disturbance height, account for the major effects of the secondary injection. The effective body analysis includes the effects of injection at an angle to the primary stream and the effects of the secondary jet exit Mach number on the interaction. Author

N69-29689*# Techtran Corp., Glen Burnie, Md.
STUDY OF THE PRECISION OF MEASUREMENTS OF GAS FLOW RATES BY THE SONIC NOZZLE METHOD [ETUDE DE LA PRECISION DES MESURES DE DEBITS GAZEUX PAR LA METHODE DU COL SONIQUE]
B. Masure Washington NASA Jun. 1969 20 p refs Transl. into ENGLISH of conf. paper Presented at a meeting of the Assoc. Tech. Maritime et Aeron., Paris, 6-10 May 1968
(Contract NASw-1695)
(NASA-TT-F-12265) Avail: CFSTI CSCL 20D

A review is presented of the formula leading to computations of a gas flow rate by the sonic nozzle method. It is shown that this relation, deduced from the one dimensional theory and applied to the flow of an inviscid gas of constant specific heat, should have three corrections factors added to it. With the case of air, the curvature of the sonic line, viscosity, and the effective compressibility are the three factors successively analyzed. Some experiments are described which confirm the computation of the effect of compressibility. Author

N69-29718# Centralny Instytut Informacji Naukowo-Technicznej i Ekonomicznej, Warsaw (Poland). Scientific Publications Foreign Cooperation Center.
A SIMPLIFIED MODEL OF BOILING DURING A TWO-PHASE SLUG FLOW IN A VERTICLE TUBE
Jan Madejski *In its* Nukleonika, vol. 10, no. 11/12, 1966 1967 p 33–64 refs (See N69-29712 16-24)
Avail: CFSTI

A simplified model of the slug flow regime is proposed by which the criteria of transitions between various two phase flow regimes can be formulated. The formation of the slug, criterion for the bubbly flow to slug flow transition, structural changes during flow of the slug-bubble ensemble, and liquid slipping rate are considered. The liquid film is analyzed with regard to both laminar and turbulent film flow, and a simplified solution for constant film thickness is discussed. Equations are given for the calculation of the heat rate, and a criterion for temporary dry-out, or burn-out, in slug flow is given. Piston velocity and the pressure drop in slug flow due to friction are also discussed. P.A.B.

N69-29762# Melbourne Univ., Parkville (Australia). Fluid Mechanics Group.
ROUGH WALL TURBULENT BOUNDARY LAYERS Final Report, Sep. 1965–Jul. 1968

Anthony E. Perry, William H. Schofield, and Peter N. Joubert. Jul. 1968 173 p refs
(Contract Nonr-5044(00))
(AD-685396; FM-1) Avail: CFSTI CSCL 20/4

The paper describes a detailed experimental study of turbulent boundary layer development over rough walls in both zero and adverse pressure gradients. Skin friction was determined by pressure tapping the roughness elements and measuring their form drag. Two wall roughness geometries were chosen each giving a different law of behaviour. However, it has been found that results for both types of roughness correlate with a Reynolds number based on wall shear velocity and on the distance below the crests of the elements from which the logarithmic distribution of velocity is measured. One important implication of this is that a zero pressure gradient boundary layer with a cavity type rough wall conforms to Rottas condition of precise self preserving flow. Author (TAB)

N69-29767# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OPTIMAL STABILIZATION OF COUETTE FLOW
T. K. Sirazetdinov Oct. 1968 11 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Aviats. Tekh. (Kazan), v. 9, no. 4 1966 p 23–28
(AD-685514; FTD-HT-23-919-68) Avail: CFSTI CSCL 20/9

The viscous flow of a fluid without excess charge between two parallel walls is considered. Author (TAB)

N69-29784*# Techtran Corp., Glen Burnie, Md.
FLOWS WITH SIMULTANEOUS NATURAL AND FORCED CONVECTION [ECOULEMENT FAISANT INTERVENIR A LA FOIS CONVECTION NATURELLE ET FORCEE]
Redyedour Kh. Zeytounian Washington NASA Jun. 1969 13 p refs Transl. into ENGLISH from Rech. Aerospatiale (France), no. 127, Nov.–Dec. 1966 p 3–9
(Contract NASw-1695)
(NASA-TT-F-12254) Avail: CFSTI CSCL 20D

This paper deals with the flow around an obstacle whose wall is subjected to a given thermal field. The perturbations of the hydrodynamic elements originated by the obstacle are then the result of the coupling between a natural convection (in the thermal boundary layer) and a forced convection (in the free stream). Only the thermal conductivity is considered (in the thermal flux equation); thence the viscosity terms are neglected in the movement equations; moreover the flow, being quasi-stationary, takes place within a layer of given height. In the linear approximation, the perturbations are superposed to a known basic flow, which is only a function of altitude. The coupling of the two convections leads to the establishment downstream of the obstacle of a periodic process; this undulating movement is in fact the result of the interaction between the thermal boundary layer and the free stream. Author

N69-29790# Royal Aircraft Establishment, Farnborough (England).
SECOND ORDER BOUNDARY LAYER THEORY FOR TWO-DIMENSIONAL AND AXIALLY SYMMETRIC FLOW [GRENZSCHICHTTHEORIE ZWEITER ORDNUNG FUER EBENE UND ACHSENSYMMETRISCHE HYPERSCHALLSTROEMUNG]
J. C. Rotta Feb. 1969 19 p refs Transl. into ENGLISH from Z. Flugwiss. (Brunswick), v. 15, nos. 8/9, 1967 p 329–334
(RAE-Lib/Trans-1315) Avail: CFSTI

It is shown that there is an interaction between pressure gradients normal and parallel to the surface in supersonic flows, and that the effect of longitudinal curvature increases strongly with Mach number. The second order boundary layer equations and the matching conditions with the inviscid flow are discussed. Longitudinal curvature, transverse curvature, and variations in stagnation pressure and enthalpy are considered as second order effects. Integral relationships of the boundary layer equations (momentum, energy equation, etc.) are given. The effects are demonstrated by a numerical example of a laminar boundary layer profile and possibilities for an approximate solution of the equations are discussed. Author

N69-29859# California Univ., Berkeley. Div. of Aeronautical Sciences.
AN EXPERIMENTAL INVESTIGATION OF NORMAL SHOCK WAVE VELOCITY DISTRIBUTION FUNCTIONS IN MIXTURES OF ARGON AND HELIUM
Laurence Harnett Feb. 1969 147 p refs
(Grant AF-AFOSR-538-68)
(AD-685289; AS-69-5) Avail: CFSTI CSCL 20/4

The electron beam-spectroscopic technique developed by Muntz for measuring simple one-dimensional moments of helium velocity distribution functions was extended for use with argon. Measurements were made on argon-helium gas mixture normal shock waves at low Mach numbers. Intensity versus wavelength profiles of single spectral lines for each gas were determined at fixed points within the shock waves with a Fabry-Perot interferometer. Lines of sight both perpendicular and parallel to the flow direction were chosen. By using appropriate calibration functions, the effect of Doppler broadening on the line structure was isolated from all other sources of line broadening, and in this way curves of parallel and perpendicular temperature for each gas as functions of position were constructed. Macroscopic velocities were measured by determining the blue shift in the line profiles when the line of sight shifted from the perpendicular to the parallel direction. The data thus obtained provided detailed information on the variation of species velocities and parallel and perpendicular temperatures within the shock waves. These results were then compared with existing theories and other experimental results. Author (TAB)

N69-29888# Boeing Scientific Research Labs., Seattle, Wash. Solid State Physics Lab.
WEAR OF SMALL ORIFICES BY STREAMING CURRENT DRIVEN CORROSION
T. R. Beck, D. W. Mahaffey, and J. H. Olsen Apr. 1969 24 p refs
(DI-82-0847) Avail: Issuing Activity

Wear on the upstream side of small metal orifices subject to large pressure drops (3000 psi) in phosphate ester base hydraulic fluids has been found to be the result of an electrochemical corrosion driven by streaming currents. A theory for the production of the streaming current by the flowing fluid is described. Results of the theory are compared with current measurements and observed wear patterns. A large variation of wall shear stress along the metal surface is found to be necessary for the wear. Author

N69-29909# Technische Hochschule Aachen (West Germany). Institut fuer Mechanik.
VISCOUS AND THERMAL BOUNDARY LAYERS IN INCOMPRESSIBLE STEADY FLOWS ALONG LONGITUDINALLY CURVED SURFACES INCLUDING BOUNDARY LAYER CONTROL. Annual Summary Report, 15 Nov. 1967–14 Nov. 1968
F. Schultz-Grunow and H. J. Henseler Nov. 1968 37 p refs
(Contract F61052-68-C-0023)
(AD-685247; ASR-8) Avail: CFSTI CSCL 20/4

Self similar solutions for the viscous and thermal boundary layer are deduced in second order approximation for flows along longitudinally curved surfaces without or with boundary layer control. The solutions cover surfaces the curvature K of which is proportional to a power of the arc length x. To this family of surfaces also belong the stagnation point flow at a cylinder and the wedge flows with curved flanks of the wedge. The apex of the

wedge is correlated to the curvature dependence on the arc length. The main problems of the work are the derivation of optimal coordinates which render a solution for the whole boundary layer and to set up a main flow being a potential flow in the framework of the approximation. Numerical solutions are deduced by applying the Runge Kutta method. Author (TAB)

N69-29961# Naples Univ. (Italy). Inst. of Aerodynamics.
ELECTROFLUID DYNAMICS. Annual Summary Report
L. G. Napolitano Jan. 1969 150 p refs
(Contract AF 61(052)-913)
(AD-685248; AI-140; ARL-69-0027) Avail: CFSTI CSCL 20/9

The report consists of two parts. In Part I a general phenomenological theory for the motion of polarizable fluids is presented. In Part II the problem of electrofluiddynamic constant area channel flow is formulated and solved. Author (TAB)

N69-29965*# Boeing Co., Seattle, Wash.
DEVELOPMENT OF DESIGN CRITERIA AND PERFORMANCE IMPROVEMENT TECHNIQUES FOR A LOW TEMPERATURE HYDRAULIC SERVO SYSTEM. Final Report
Mar. 1968 124 p refs
(Contract NAS8-20579)
(NASA-CR-61644; D2-114069-1) Avail: CFSTI CSCL 20D

The investigation of practical uses of hydraulic systems for space applications has been under study in progressive research steps for some years. The purpose of the research program was to determine the degree of acceptability of off-the-shelf servovalve design for low temperature space applications and to evaluate possible improvements exclusive of major redesign. The necessity for such research stems from identifying the servovalve as the servo system component most sensitive to viscosity and temperature change. Since space actuation requirements embrace a temperature range of 275 to −240°F (viscosities of less than 0.5 cs to greater than 50,000 cs; depending on fluid selection) the influence of viscosity as a function of temperature has a very real effect on servovalve and servo system performance. The independent effects of viscosity and temperature on servovalve and servo system performance were examined during the test evaluations. The analytical study comprised development of a transfer function for a typical servovalve and evaluation of the viscosity effects on constituent terms of the transfer function. Author

N69-30071*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
FLOW-FIELD MEASUREMENTS DOWNSTREAM OF TWO PROTUBERANCES ON A FLAT PLATE SUBMERGED IN A TURBULENT BOUNDARY LAYER AT MACH 2.49 AND 4.44
Lana M. Couch Washington Jul. 1969 136 p refs
(NASA-TN-D-5297) Avail: CFSTI CSCL 20D

Pitot pressure, static pressure, and total temperature distributions were obtained on a flat plate and on the portion of a flat plate downstream of a plate-mounted cylinder and of a plate-mounted fairing at free-stream Mach numbers of 2.49 and 4.44. Velocity gradients adjacent to the plate surface downstream of both models were greater than those obtained on the plate surface and indicate higher shearing stress and heat transfer to the plate surface within the model wakes. The extent of mixing downstream of both models, as indicated by velocity profiles, decreased with increasing Mach number. Increasing the unit Reynolds number by a factor of 2 had only a negligible effect on the profiles obtained on the flat plate. Flow patterns on the plate surface (as shown by oil-flow photographs) downstream of both models indicated some regions of similarity. Author

N69-30153# Northwestern Technological Inst., Evanston, Ill. Dept. of Engineering Sciences.
THE RESPONSE OF A CIRCULAR MODEL GREAT LAKE TO A SUDDENLY IMPOSED WIND STRESS
G. E. Birchfield [1968] 22 p refs
(GRANT NSF GA-1078)
Avail: Issuing Activity

Corrections are derived to errors in a previous paper by another author calculating the response of a two-layer model lake of constant total depth and circular boundary to a suddenly imposed spatially uniform wind stress. The previous paper is part of a series concerned with the application of classical hydrodynamic theory to the Great Lakes. The present paper is divided into three parts: solution of the model equations; barotropic motions of the two-layer model Great Lake; and baroclinic motions of the two-layer model Great Lake. Conclusions are offered which differ from the original conclusions, and errors in computation are detailed. K.R.G.

N69-30247*# Aztec School of Languages, Inc., Maynard, Mass.
DYNAMICS OF A FLUID IN A CONICAL TANK DURING THE TRANSITION FROM SMALL TO APPRECIABLE GRAVITY [DINAMIKA ZHIDKOSTI V KONICHESKOM BAKE PRI PEREKHODE OT MALOY VESOMOSTI K ZNACHITELNOY]
V. M. Shushin Washington NASA Jun. 1969 10 p refs Transl. into ENGLISH From Izv. Akad. Nauk SSSR, Mekh. Zhidk. Gaza (Moscow), no. 6, 1968 p 74–79
(Contract NASw-1692)
(NASA-TT-F-12343) Avail: CFSTI CSCL 20D

The dynamic loads that can arise in fuel tanks when the engine is fired under weak gravity conditions are disclosed. These loads may cause an intense surge of the fuel over the tank walls. The analysis is performed for an axisymmetric vortex-free motion of an ideal fluid in a conical container with a spherical bottom, when this motion is induced by an axial acceleration applied to the tank. The problem is reduced to the solution of partial differential equations with an unknown mobile boundary and nonlinear conditions at the boundary. A solution of these equations is obtained by the Fourier method. Author

N69-30257# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE PROBLEM OF THE INTERACTION OF A JET WITH AN UNBOUNDED FLOW IN THE CASE OF HIGH SPEEDS AT INFINITY
A. Ya. Sagomonyan Jul. 1968 13 p refs Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. 1: Mat. i Mekhan. (Moscow), v. 22, no. 4, 1967 p 99–104
(AD-685089; FTD-HT-23-320-68) Avail: CFSTI CSCL 20/4

The problem of interaction between a jet and an opposite homogeneous supersonic flow is investigated. The approach used for determining the contact surface of two streams consists of assuming the shape of the interface to be in the form of a one-parameter surface and determining the dependence of the interface parameter on the initial parameters of the flow and jet with the aid of integral laws of mechanics. The approximate solution obtained at the stagnation point can be extended downstream by known methods. In the case of supersonic flow, for example, the solution is obtained by the method of characteristics. The method is substantiated by several examples related to the interaction of incompressible flows. Expressions are derived for forces exerted on the interface by jet and flow, from which the parameter of the contact surface is determined. The results show that the diameter of the contact surface is proportional to the diameter of the jet and that the proportionality coefficient depends on the initial nondimensional flow parameters. A scheme for solving the problem of jet-flow interaction at arbitrary supersonic velocities by means of a computer is described. Author (TAB)

N69-30302# General Electric Co., Philadelphia, Pa. Missile and Space Div.

NUMERICAL INVESTIGATION OF THE FORMATION OF DISCONTINUITIES IN NONISENTROPIC INVISCID FLOWS

Paul Gordon and Sinclaire M. Scala Jan. 1969 53 p refs Presented at the Intern. Symp. on High Speed Computing in Fluid Dyn., Monterey, Calif., 19–24 Aug. 1968

(Contracts N00014-68-C-0404; N60921-7164)

(AD-685616; DOC-69SD1) Avail: CFSTI CSCL 20/4

The possibility of the occurrence of discontinuities in inviscid flows governed by the Euler Equations is a well-recognized phenomenon. It has been established mathematically that discontinuities must appear in some circumstances: a planar piston accelerating into a stationary isentropic fluid must produce a shock discontinuity. Artificial viscosity techniques have been developed in order to overcome the difficulties associated with mathematical discontinuities. The report considers two questions: (1) Is it possible to utilize a numerical scheme for the inviscid equations, for both isentropic and nonisentropic flow, such that the stability of the method does not depend on an artificial viscosity effect. (2) Is it possible to have continuous nonisentropic, inviscid flows in which there are subsonic and supersonic regions. Author (TAB)

N69-30313# Cornell Univ., Ithaca, N.Y. Dept. of Theoretical and Applied Mechanics.

SHOCK WAVE PROPAGATION AND DIFFRACTION Final Report, 1 May 1967–31 Aug. 1968

John P. Moran Mar. 1969 4 p

(Contract DAHC04-67-C-0044)

(AD-684948; AROD-6553.4-E) Avail: CFSTI CSCL 16/4

Work was directed toward the accurate numerical solution of certain problems in high speed gasdynamics which are difficult to treat by conventional numerical methods. Mainly studied was the steady axisymmetric supersonic flow about a blunt body and the transient flows which result when a smooth blunt body, either at rest or in supersonic motion, is struck by a shock wave such as might be created by an explosion. In each of the cases to which the method was applied, the results obtained were far less complete than could be found. Since the finite-difference methods tend to be more inaccurate where the present approach is successful, the two methods complement one another. Author (TAB)

N69-30319# Joint Publications Research Service, Washington, D.C.

INVESTIGATION OF TURBULENCE BY OPTICAL METHODS

N. F. Derevyanko et al 4 Jun. 1969 25 p refs Transl. into ENGLISH From Zh. Prikl. Mekhan. i Techn. Fiz. (Moscow), no. 4, Jul.–Aug. 1968 p 105–116

(JPRS-48162) Avail: CFSTI

The application of optical methods for measuring the characteristics of turbulence in liquids, as well as in gases, flames and plasma, is reviewed. The optical methods used for investigating turbulence are divided into three groups: (1) diffusion methods, based on the utilization of dependence of the diffusion of heat and micro- or macroparticles; (2) densitometric methods, based on the detection of turbulent density fluctuations and encompassing two subgroups known as the traveling light methods and the scattered and self-radiation methods; and (3) anemometric methods, based on the measurement of fluctuations of velocity and including two subgroups known as the spectral methods and the kinematic methods. D.L.G.

N69-30337# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).

VKI SHORT COURSE ON TURBULENT BOUNDARY LAYERS, 4 MARCH–18 MARCH 1968, PARTS 1 AND 2

Mar. 1968 144 p refs

(VKI-LS-5-PT-1-PT-2) Avail: CFSTI

Turbulent boundary layer phenomena are treated in a series of analytical discussions. The basic principles of boundary layer theory and the mechanics of turbulent shear flow are defined, followed by specific treatment of the following topics: (1) general behavior of turbulent boundary layers in incompressible flow; (2) methods for calculating these layers; and (3) analysis of turbulent layers with heat transfer and incompressible flow. A detailed computation of boundary layer development using the turbulent energy equation is also included. This method of prediction is based on the hypothesis that the relationships between turbulent shear stress and other turbulence properties are sufficiently universal for engineering purposes to represent the functions by only a few parameters. Mixing length theory is shown to be a special case of the method. A.C.R.

N69-30366# Boeing Co., Seattle, Wash. Office of International Operations.

TURBULENT BOUNDARY LAYER STUDIES ON A WAISTED BODY OF REVOLUTION IN SUBSONIC AND SUPERSONIC FLOW

K. G. Winter, J. C. Rotta, and K. G. Smith Apr. 1969 77 p refs Transl. into ENGLISH of Deutsche Luft- und Raumfahrt, Forschungsbericht 65–52, Nov. 1965

(B-533) Avail: CFSTI

The effects of Mach number and pressure gradient, as well as convergence and divergence of streamlines, on the development of the turbulent boundary layer have been studied. Pressure distributions, local skin friction coefficients, and boundary layer velocity profiles have been determined experimentally at Mach numbers ranging from 0.6 to 2.8. Calculations have been made, the basis of which is simultaneous integration along the body of the momentum and kinetic energy equations of the boundary layer. The results of the tests and calculations agree with respect to the general development of displacement, momentum, and kinetic energy thickness as well as skin friction coefficient. In the attempt to explain the observed differences, it was found that the surface curvature had a considerable effect on the development of the turbulent boundary layer at supersonic flow. Author

N69-30368# Massachusetts Inst. of Tech., Cambridge. Hydrodynamics Lab.

A STUDY IN THE INTERRELATION BETWEEN TURBULENCE, ROUGHNESS AND CAVITATION FOR WALL SHEAR FLOWS Final Report, Sep. 1965–Dec. 1968

A. T. Ippen 28 Feb. 1969 5 p refs

(Contract DA-31-124-ARO(D)-410)

(AD-684933; AROD-6024-3-E) Avail: CFSTI CSCL 20/4

The report consists of a brief review of work accomplished, personnel associated with the project, a list of references, and awards received during the contract period. TAB

N69-30393# Colorado State Univ., Fort Collins. Fluid Dynamics and Diffusion Lab.

TURBULENCE SPECTRA IN THE BUOYANCY SUBRANGE OF THERMALLY STRATIFIED SHEAR FLOWS

Jung-Tai Lin, S. Panchev, and J. E. Cermak Feb. 1969 147 p refs

(Contract N00014-68-A-0493)

(AD-684877; CER68-69JTL21; THEMIS-CER-TR-1) Avail: CFSTI CSCL 20/4

A generalized eddy-viscosity approximation is used to study the turbulence spectra of thermally stratified shear flows. Numerical solutions of turbulence spectra are investigated. Modified hypothesis in the buoyancy subrange of stably stratified flow is given. Author (TAB)

13 GEOPHYSICS

Includes seronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N69-29015# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
DESIGN AND EVALUATION OF A DEVICE FOR DETERMINING THE ONE-DIMENSIONAL COMPRESSION CHARACTERISTICS OF SOILS SUBJECTED TO IMPULSE-TYPE LOADS Final Technical Report
Larry Schindler Nov. 1968 390 p refs Supported by DASA (AD-680317; TR-S-68-9) Avail: CFSTI CSCL 8/13

A general-purpose test facility for determining the one-dimensional compression characteristics of soils subjected to impulse-type loads has been developed in order to help satisfy the ever-increasing demand for reliable soil-property data required in support of a wide variety of nuclear-weapons-effects-related problems. The design, fabrication, installation, and evaluation of the various elements which together comprise the test facility were accomplished. The various considerations involved in the design and evaluation of the newly developed test facility are discussed in detail, thus providing some insight into the types of factors which affect the experimental accuracy capability of a one-dimensional compression test facility and thereby the reliability of the data obtained under any particular set of conditions. Author (TAB)

N69-29021# Illinois Univ., Urbana.
GRAPHICAL TRANSFORMATION AND COMPARISON OF PLANE COORDINATE SYSTEMS
L. A. White Oct. 1968 34 p *its* Photogrammetry Ser. No. 21 (PB-182716) Avail: CFSTI CSCL 08E

A simple graphical method is presented to transform coordinates from one plane coordinate system onto another, to examine the factors operating and to isolate inconsistent points. The transformation allows for the effects of orientation, magnification, and translation operating between the systems. The determination of the constants by this means is equivalent to a rigorous least squares solution. Author (USGRDR)

N69-29065# Haile Sellassie Univ., Addis Ababa (Ethiopia).
BULLETIN OF THE GEOPHYSICAL OBSERVATORY, NO. 12
Jul. 1968 77 p refs Partly in ENGLISH and partly in FRENCH
Avail: CFSTI

CONTENTS:

1. ANNULAR FAULTING IN THE ETHIOPIAN RIFT SYSTEM P. A. Mohr p 1–9 refs (See N69-29066 16-13)
2. ON THE ENHANCEMENT OF GEOMAGNETIC STORMS SUDDEN COMMENCEMENTS (SC) AT ADDIS ABABA J. Roquet (Paris Univ., France) p 11–18 refs (See N69-29067 16-13)
3. SURFACE SEISMIC WAVE DISPERSION AND CRUSTAL STRUCTURE BETWEEN GULF OF ADEN AND ADDIS ABABA P. B. Jones p 19–26 refs (See N69-29068 16-13)
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6. SPECTRUM ANALYSIS TECHNIQUES APPLIED TO THE STUDY OF LATITUDE EFFECTS ON GEOMAGNETIC MICROPULSATIONS F. Giangeaud, J. Roquet, E. Sieor (Paris Univ., France), and P. Gouin p 67–74 refs (See N69-29071 16-13)

N69-29066# Haile Sellassie Univ., Addis Ababa (Ethiopia).
ANNULAR FAULTING IN THE ETHIOPIAN RIFT SYSTEM
P. A. Mohr *In its* Bull. of The Geophys. Obs., No. 12 Jul. 1968 p 1–9 refs (See N69-29065 16-13)
Avail: CFSTI

Annular faulting on the floor of northeastern Afar, Ethiopia, may have been caused by crustal rotation and subsidence, in response to rift tension and transcurrent movement. Author

N69-29067# Paris Univ. (France). Inst. de Physique du Globe.
ON THE ENHANCEMENT OF GEOMAGNETIC STORMS SUDDEN COMMENCEMENTS (SC) AT ADDIS ABABA [SUR L'AMPLIFICATION DES DEBUTS BRUSQUES D'ORAGES MAGNETIQUES A ADDIS ABABA]
J. Roquet *In* Haile Sellassie Univ. Bull. of The Geophys. Obs., No. 12 Jul. 1968 p 11–18 refs In FRENCH; ENGLISH summary (See N69-29065 16-13)
Avail: CFSTI

The stations at Addis Ababa and Bangui are located, respectively, at −0.5° and −6° to the south of the magnetic zero-dip equator. A comparative study of 109 geomagnetic storm sudden commencements (SC) recorded at both stations from 1958 to 1965 reveals a clear diurnal variation in the amplitude of the initial SC-onsets at AA in contrast with a rather weak, even doubtful diurnal variation at Ba. The enchancement in the amplitude of the H-component of the SC-onsets at AA exists practically only during daytime and is closely related to the equatorial electrojet effect. Although these two equatorial sections are seperated by only 20° of longitude, the number of SC is higher at AA than at Ba; their hourly distribution corresponds to that found by Matsushita. Author

N69-29068# Haile Sellassie Univ., Addis Ababa (Ethiopia).
SURFACE SEISMIC WAVE DISPERSION AND CRUSTAL STRUCTURE BETWEEN GULF OF ADEN AND ADDIS ABABA
P. B. Jones *In its* Bull. of the Geophys. Obs., No. 12 Jul. 1968 p 19–26 refs (See N69-29065 16-13)
Avail: CFSTI

Dispersion curves for surface waves recorded at Addis Ababa from epicenters in and near the Gulf of Aden were plotted. Comparison of these curves with those obtained from other areas indicates that the region between the western end of the Gulf of Aden and the Ethiopian Plateau, known as the Afar, is underlain by predominantly continental crust. Author

N69-29069# Haile Sellassie Univ., Addis Ababa (Ethiopia).
GRAVITY TRAVERSES IN ETHIOPIA Interim Report
P. A. Mohr and P. Gouin *In its* Bull. of the Geophys. Obs., No. 12 Jul. 1968 p 27–56 refs (See N69-29065 16-13) (IR-4) Avail: CFSTI

The following new gravity survey loop in southern Ethiopia was made: (1) Addis Ababa and Shashamanne; (2) Shashamanne and Kilito; (3) Kolito, Soddu, Arba Minch and Gardula; (4) Gardula, Jarso and Yavello; (5) Yavello, Alghe, Dilla and Shashemanne; (6) Shashamanne, Dodola and Adeba; (7) Adaba, Bokoji and Asella; (8) Asella, Alem Tenna and Addis Ababa. Some of these stages of the loop involve duplication and/or extension of previously published profiles. Stages 2, 4, 6 and 8 run perpendicular to the main Ethiopian rift whereas stages 3, 5 and 7 run parallel to, and sometimes within this rift. Author

N69-29070# Paris Univ. (France). Inst. de Physique du Globe.
ULF GEOMAGNETIC RECORDING SYSTEM AT ADDIS ABABA
P. Gouin and J. Roquet *In* Haile Selassie Univ. Bull. of The Geophys. Obs., No. 12 Jul. 1968 p 57–65 refs (See N69-29065 16-13)
Avail: CFSTI

A set of rapid-run flux-gate variometers were installed at the Geophysical Observatory in Addis Ababa during February 1965. The system used at Addis Ababa comprises: (1) two transducers orientated NS (H) and EW (D), (2) one double-track double-band photocell preamplifier, and (3) one double-trace Sefram strip-chart visual recorder with variable speeds ranging from 1.2 to 300 mm/minute. The system allows the choice of a short period (SP) band passing from 0.3 to 10 seconds and corresponding to pc 1, pc 2 and pi 1 and a medium period (MP) band passing from 10 to 150 seconds and corresponding to pc 3, pc 4, and pi 2. The basic time-bases used are 6 mm/minute for the MP micropulsations and 30 mm/minute for the SP. Author

N69-29071# Paris Univ. (France). Inst. de Physique du Globe.
SPECTRUM ANALYSIS TECHNIQUES APPLIED TO THE STUDY OF LATITUDE EFFECTS ON GEOMAGNETIC MICROPULSATIONS [APPLICATIONS DES METHODES D'ANALYSE SPECTRALE A L'ETUDE DES EFFECTS DE LATITUDE DANS LE DOMAINE DES VARIATIONS MAGNETIQUES RAPIDES]
F. Glangeaud, P. Gouin, (Haile Selassie Univ., Addis Ababa) J. Roquet, and E. Selzer *In* Haile Selassie Univ. Bull. of the Geophys. Obs., No. 12 Jul. 1968 p 67–74 refs In FRENCH; ENGLISH summary (See N69-29065 16-13)
Avail: CFSTI

Simultaneous recordings of the rapid variations of the geomagnetic field were performed at Lerwick in Shetlands (Scotland), Chambon-la-Foret in France and Addis Abeba in Ethiopia from November 1967 to April 1968. The design philosophy of the system used at all stations and the methods of interpreting both the magnetic tapes and the strip-chart records are described. For illustration purposes, a brief analysis of the sonograms of the 5th, 6th, and 7th of December 1967 is presented. Author

N69-29078# Bureau of Mines, Washington, D.C.
NEAR-SURFACE HORIZONTAL STRESSES INCLUDING THE EFFECTS OF ROCK ANISOTROPY
Verne E. Hooker and Charles F. Johnson Feb. 1969 33 p refs (PB-182690; RI-7224) Avail: CFSTI CSCL 08G

In situ stresses, based on isotropic and anisotropic relations, were evaluated using computer techniques from overcoring data obtained in dimension stone quarries along the Appalachian Piedmont, the Ozark Uplift, and the Ouachita Tectonic Belt. Stresses in the horizontal plane near the surface are compressive range from 100 to 4,500 psi. The direction of maximum compressive stress seems to be alined with the general tectonic structure for most of the determinations. The ratio of the maximum to minimum elastic parameters in the horizontal plane ranges from 1.05 to 2.46 for these competent rocks. Isotropic versus anisotropic stress determinations show differences only as great as 25 percent in stress magnitude and 25 degrees in orientation. Author (USGRDR)

N69-29108# Geological Survey, Denver, Colo.
LITHOLOGIC LOG OF EMPLACEMENT DRILL HOLE UA-1 FROM 5,000 TO 6,500 FEET, AMCHITKA ISLAND, ALASKA
Its Amchitka 6-3
William H. Lee 14 Feb. 1969 5 p
(Contract AT(29-2)-474)
(USGS-474-4) Avail: CFSTI CSCL 22C

Emplacement drill hole UA-1, located at Site C, was continuously cored in a center-punched hole from 5,020 to 6,500 feet. The center-punch hole was entirely within the older breccias and basalts. Units within the interval penetrated by the center-punch hole are generally 30 to 50 feet lower than comparable units in drill hole UAe-1, 300 feet to the southwest. Author (NSA)

N69-29134 Washington Univ., Seattle.
AN EXPERIMENTAL STUDY OF THE POLAR LOWER IONOSPHERE USING VERY LOW FREQUENCY RADIO WAVES
Ward Julian Helms (Ph.D. Thesis) 1968 111 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-1179

A new experimental technique has been devised to study the lower ionosphere using very low frequency radio waves. This technique determines an accurate phase height of reflection without ambiguity. A system implementing this technique has been designed, constructed, and put into operation at Byrd Station, Antarctica. Seven months of synoptic data on the polar lower ionosphere have been obtained and analyzed. The analysis of these data has yielded the average behavior of the polar D-region during periods of total darkness, continuous sunlight, and day–night night–day transition under both quiet and disturbed magnetic conditions. This analysis indicates that the dominant ionization production mechanism is related to energetic particle precipitation from the magnetosphere and is only slightly affected by solar ultraviolet radiation. Dissert. Abstr.

N69-29161 Northwestern Univ., Evanston, Ill.
MOHR-COULOMB STRENGTH THEORY FOR ANISOTROPIC COHESIVE SOILS
Wallace Hayward Baker (Ph. D. Thesis) 1968 229 p
Avail: Univ. Microfilms: HC $10.35/Microfilm $3.00 Order No. 69-1790

A general solution of the Mohr-Coulomb strength criterion is developed for anisotropic materials, and this solution is employed in an analytical investigation of the shear strength of cohesive soils. As a companion equation to the Mohr-Coulomb solution, a comprehensive pore pressure equation, modeled in part after Hill's criterion for the strength of anisotropic metals, is proposed. The combination of the solution to the Mohr-Coulomb equation and the pore pressure equation is discussed and illustrated for the case of a conventional triaxial test. The analytical results of this study provide a rational basis for interpreting the effective stress strength anisotropy found in many natural and compacted soils. In addition, an important by-product of this work is the multitude of physical implications that result from the extension of the Mohr-Coulomb theory to anisotropic materials; these implications are considered with relation to strength testing of soils. Dissert. Abstr.

N69-29162# Army Engineer Waterways Experiment Station, Vicksburg, Miss.
MEMBRANE ENVELOPE TECHNIQUE FOR WATERPROOFING SOIL BASE COURSES FOR AIRSTRIPS. BARE BASE SUPPORT
Cecil D. Burns and William N. Brabston Jul. 1968 83 p refs (AD-684356; AEWES-Misc-Papers-S-68-13) Avail: CFSTI CSCL 8/13

The purposes of the investigation reported herein were to (a) determine the techniques required to construct a waterproof fine-grained soil base course by encasing the soil layer in a protective membrane envelope, (b) evaluate several types of membranes for use in this waterproofing technique, and (c) determine the effects of aircraft traffic under a range of weather conditions on a base course so constructed. A test section was constructed having (a) a highly compacted lean clay base course over a low

strength subgrade of the same soil, and (b) a heavy clay base course over a loose sand subgrade. During construction, various surface and subsurface membranes were bonded together to form a single watertight envelope encasing both base courses.
Author (TAB)

N69-29185 Northwestern Univ., Evanston, Ill.
ENERGY DISSIPATION AND NONLINEAR MECHANICAL RESPONSE IN A KAOLIN CLAY
Arley Graves Franklin (Ph.D. Thesis) 1968 199 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 69-1831

This investigation has the aim of contributing to the development of stress-strain-time relations for soils by studying the behavior of a particular soil. A series of torsional shear tests in sinusoidal oscillation has been performed on a Georgia kaolin clay, and the results are expressed in terms of complex viscoelastic response parameters. Some aspects of the limitations and usefulness of the theory of linear viscoelasticity for the analysis of soil behavior are examined by (1) study of the shapes of hysteresis loops generated by cyclical deformation, (2) study of the strain amplitude dependence of the response parameters and (3) comparison of energy dissipation as calculated by viscoelastic relations with that measured directly from the areas within the hysteresis loops. The tests were performed with a rotational viscometer using a cone-and-plate sample holder in order to provide homogeneity of strains and stresses. Dissert. Abstr.

N69-29274# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SEISMIC DISCRIMINATION Semiannual Technical Summary Report, 1 Jul. - 31 Dec. 1968
Paul E. Green Jan. 1969 42 p refs
(Contract AF 19(628)-5167; ARPA Order 512)
(AD-682297; ESD-TR-68-369) Avail: CFSTI CSCL 17/10

Seismic source identification work during this reporting period has emphasized improving the ability of short-period discriminants to work at lower magnitudes, and the use of a wider variety of stations, including especially the norsar site in Scandinavia. During this period, plans to upgrade our signal analysis capability and at the same time move into closer proximity to the academic part of M.I.T. have reached partial fruition. Author (TAB)

N69-29390*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
ULTRAVIOLET ABSORPTION AND STIMULATED LUMINESCENCE INVESTIGATIONS. PART 1: ULTRAVIOLET VIDEO IMAGING SYSTEM. PART 2: SPECTRAL DISTRIBUTION OF ULTRAVIOLET STIMULATED LUMINESCENCE. PART 3: MEASUREMENT OF ULTRAVIOLET REFLECTANCE Interim Report
William R. Hemphill comp., T. M. Sousa comp., Stephen J. Gawarecki, William A. Fischer, David L. Daniels et al Nov. 1964 120 p refs Prepared by Geological Survey, Washington, D.C.
(NASA Order R-146)
(NASA-TM-X-61721; NASA-3) Avail: CFSTI CSCL 08E

Studies involving the interactions of parts of the ultraviolet spectrum with natural objects are aimed at an appraisal of the value of the ultraviolet spectrum for mapping the surface chemical and/or physical characteristics of parts of the earth and the other planetary bodies. These investigations include development and appraisal of various types of instrument systems (both passive and active) which respond to or permit measurement of ultraviolet reflection or ultraviolet-stimulated luminescence. Progress is reported on a three-phase appraisal of an ultraviolet video imaging system and a program of measurement of the spectral distribution of ultraviolet stimulated luminescence. This latter investigation is primarily designed to provide data on which to base filter selection for use in the first investigation. A third study involving measurement of ultraviolet reflectance of various natural objects is now inactive, sufficient data having been gathered to satisfy the initial need for such data and to evaluate the usefulness of the equipment.
Author

N69-29481*# National Aeronautics and Space Administration, Washington, D. C.
THE FACE OF THE EARTH AND ITS ORIGIN
G. N. Katterfeld Jun. 1969 134 p refs Transl. into ENGLISH of the book "Lik Zemli i ego Proiskhozhdeniye" Moscow, State Publishing House of Geograph. Lit., 1962
(NASA-TT-F-533) Avail: CFSTI CSCL 08E

The terrestrial deforming forces derived, from its rotation, and from alternate compression and expension of the terrestrial body (pulsation), associated with the action of gravity and with that of internal physicochemical reactions are studied. It is shown that the net result of the interaction of these forces over the course of enormous periods of time has been the establishment of lines of maximal stress which have given rise to tectonic movements in the mantle. This has led to the well-known antipodal character of terrestrial relief: land masses (elevations) on one side of the globe are counterbalanced by water masses (depressions) on the other; and also to a number of other peculiarities, such as the wedge shape exhibited by the continents, and the distribution of volcanic activity. It is believed that the tidal action of the moon (which originated in nearby space at the same time as the earth) was an important factor leading to the imbalance in terrestrial relief.
Author

N69-29486# Geological Survey, Denver, Colo.
SOME PHYSICAL PROPERTIES OF ROCKS IN DRILL HOLE UAe-2, AMCHITKA ISLAND, ALASKA
William H. Lee 15 Feb. 1969 14 p refs *Its* Amchitka 10-2
(Contract AT(29-2)-474)
(TID-24986; USGS-474-5) Avail: CFSTI

Physical properties of rocks from drill hole UAe-2 are analyzed by averaging and minimum-maximum ranging. Data source for the analysis is Birdwell 3-D log computations. Laboratory determinations are presented in table form. Rocks in the drill hole were divided into 12 separate lithologic types for purposes of analysis. The physical properties of similar lithologic types are compared and the conclusion is drawn that alteration significantly changes the properties of the rock.
Author (NSA)

N69-29496# Geological Survey, Denver, Colo.
SUMMARY GEOLOGIC REPORT ON THE U20e EMPLACEMENT HOLE, PAHUTE MESA, NEVADA TEST SITE
K. A. Sargent 24 Feb. 1969 6 p ref *Its* Spec. Studies No. 25
(Contract AT(29-2)-474)
(TID-24987-Suppl-2) Avail: CFSTI

Emplacement hole U20e, in Area 20, Pahute Mesa, Nevada Test Site, has a total depth of 3,883 feet. Stratigraphic units correlate very closely with those in UE20e-1, approximately 1,500 feet to the northeast.
Author (NSA)

N69-29510 California Univ., Irvine.
COSMIC RAYS AND WEAK INTERACTIONS: A CRITICAL REVIEW OF THE EXPERIMENTAL STATUS
F. Reines *In* CERN Topical Conf. on Weak Interactions 27 Mar. 1969 p 1D1-1D9 (See N69-29504 18-24)
Copyright. Avail: Issuing Activity

The salient features of various experiments by cosmic ray physicists concerning the field of weak interactions are described. Two experimental programs gave evidence for the interaction of high energy atmospheric neutrinos; these results are summarized, and some statements about their implication for the cross section of muon-type neutrinos above 10 GeV are made. Another experiment obtained a result suggesting an excess of muons reaching the earth surface at large zenith angles; the existence of a new production process for muons in the several thousand GeV range is implied. Muon decay (in the few hundred GeV region) produced by neutrals in the cosmic rays at the earth surface was observed by an experimental group. An experiment on lower solar neutrinos (approximately 1 MeV) is giving negative results to date. P.A.B.

N69-29511 New York Univ., N.Y. Dept. of Physics.
NEUTRINOS IN ASTROPHYSICS
M. A. Ruderman *In* CERN Topical Conf. on Weak Interactions 27 Mar. 1969 p 111–130 (See N69-29504 16-24)
Copyright. Avail: Issuing Activity

Current thoughts concerning solar neutrinos are summarized, including the calculated neutrino flux from the sun and experimental results on lower solar neutrinos. Weakly interacting neutrinos emitted by hot stellar cores are emphasized. Attempts to use astronomical observations to gain information concerning the form and magnitude of the canonical weak electron–neutrino self-coupling are surveyed. Present evidence supports a self electron–neutrino coupling of the kind and strength suggested by a universal Fermi interaction. Included in the discussion are the evolution of massive stars; isotopic abundances; the cooling of degenerate stars, including planetary enbulae central stars and hot white (ultraviolet) dwarfs; and magnitude bounds. P.A.B.

N69-29542# Pennsylvania State Univ., University Park. Ionosphere Research Lab.
IONOSPHERIC D-REGION PARAMETERS FROM BLUNT PROBE MEASUREMENTS DURING A SOLAR ECLIPSE, PART B. Final Report
Duncan C. Baker Feb. 1969 110 p refs
(Contract DAAD05-67-C-0005)
(AD-684322; SR-334) Avail: CFSTI CSCL 4/1

A series of four rocket experiments were performed during the solar eclipse of November 12, 1966, at Cassino, Brazil, to determine the positive and negative conductivities of the atmosphere below 80 km. The conductivity data was interpreted in terms of positive and negative ion and electron densities. The density data was used with the positive ion continuity equation to determine the ion-ion recombination coefficient. Author (TAB)

N69-29543# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
DIFFUSION LAW FOR THE DISPERSION OF HARD PARTICLES IN AN ICE MATRIX THAT UNDERGOES SIMPLE SHEAR DEFORMATION
Johannes Weertman Sep. 1968 15 p refs
(AD-680958; CRREL-RR-252) Avail: CFSTI CSCL 8/12

A diffusion equation is obtained that describes the mechanical dispersion of a dilute mixture of solid particles within an ice matrix that is undergoing deformation. It is shown that within the limits of time intervals and strain rates appropriate to the movement of glaciers and ice sheets the dispersal distance usually is no larger than a distance about one order of magnitude greater than the size of the particles themselves. Author (TAB)

N69-29578# Sheffield Univ. (England). Dept. of Applied Mathematics and Computing Science.
A SURVEY OF SOME RECENT RESEARCH ON MAGNETO-PLASMA DIFFUSION AND THE IONOSPHERIC F2 LAYER, PART 1 Final Report, 1 Jan. 1965–30 Jun. 1968
V. C. Ferraro and P. C. Kendall Jan. 1969 58 p refs Prepared in cooperation with Queen Mary Coll.
(Grant AF-EOAR-74-64)
(AD-684715; AFCRL-69-0106) Avail: CFSTI CSCL 4/1

Recent work on magnetoplasma diffusion carried out at Queen Mary College, University of London and the University of Sheffield is reviewed, including reference to some other current work on meteor trains, the general problem of magnetoplasma diffusion, and the problem of diffusion in the ionospheric F2-layer. Author (TAB)

N69-29634# California Univ., Berkeley. Seismographic Station.
THE CENTRAL CALIFORNIAN LARGE-SCALE SEISMIC ARRAY Annual Report, 1 Jan.–31 Dec. 1968
Bruce A. Bolt and T. V. McEvilly 31 Dec. 1968 35 p refs
(Contract AF 49(638)-1506; ARPA Order 292)
(AD-683751; REPT-1506-18) Avail: CFSTI CSCL 8/11

Contents: Seismological inferences from S wave studies using local earthquakes. California seismicity and tectonics. Frequency spectral analysis of recordings from array stations to estimate crustal properties. Detailed crustal structure within array. Crystal profile from boxcar and benham across Great Valley and coast ranges. Use of the array for studies of the earth's interior. Postboxcar and benham seismic events. TAB

N69-29710*# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
EXPERIMENTAL VERIFICATION OF DRIFT SHELL SPLITTING IN THE DISTORTED MAGNETOSPHERE
K. A. Pfitzer, T. W. Lezniak, and J. R. Winckler Apr. 1969 13 p refs
(Grant NGL-24-005-008)
(NASA-CR-101841; CR-133) Avail: CSFTI CSCL 04A

Electron spectrometer data from the synchronous ATS-1 and data from an electron spectrometer and ion chamber on the elliptical orbit satellite OGO-3 can be used to test drift shell splitting in the non-dipolar distorted magnetosphere. Quiet day pitch angle distributions obtained by ATS-1 at 6.6 R_e qualitatively confirm the shell splitting by showing that near noon the pitch angle distribution is nearly isotropic whereas near midnight it is peaked toward small angles parallel to the field. Using the Mead model magnetic field for calculating the drift shells for electrons of pitch angle $\alpha = 65°$ and $\alpha = 90°$, as well as the measured pitch angle distribution and measured radial gradient for electrons at local noon, the pitch angle distribution can be calculated as a function of local time for the ATS-1 orbit. Calculated and measured fluxes agree not only in predicting the proper noon to midnight asymmetry (25 to 1 for 500 to 1000 keV electrons on February 15, 1967) but also in correctly predicting the pitch angle distribution as a function of local time (isotropic at noon but non-isotropic with a 3 to 1 ratio between $\alpha = 65°$ and $\alpha = 90°$ at midnight). However, in one case (15 February, 1967) an asymmetry is observed about local midnight with minimum count rate at 2200 LT. Author

N69-29735# Ohio State Univ. Research Foundation, Columbus.
GLACIOLOGY AND METEOROLOGY OF ANVERS ISLAND. VOLUME 1: SURFACE METEOROLOGICAL DATA FOR PALMER STATION, ANTARCTICA, 1 FEBRUARY - 31 DECEMBER 1965

Arthur S. Rundle, William F. Ahmsbrak, and Charles C. Plummer Jun. 1968 376 p
(Grant NSF GA-165)
(RF-1885-Vol-1) Avail: Issuing Activity

The results of surface meteorological observations made at the United States Antarctic Research Program facility, Palmer Station, between February 1 and December 31, 1965 are presented. Observations for dry and wet-bulb temperature, wind speed and direction, station pressure, cloud cover, and current weather are tabulated for three-hour intervals. F.O.S.

N69-29736# Ohio State Univ. Research Foundation, Columbus.
GLACIOLOGY AND METEOROLOGY OF ANVERS ISLAND. VOLUME 2: SURFACE METEOROLOGICAL DATA FOR PALMER STATION, ANTARCTICA, 1 JANUARY - 31 DECEMBER 1966
Arthur S. Rundle and Steven R. Dawitt Jun. 1968 407 p
(Grant NSF GA-165)
(RF-1885-Vol-2) Avail: Issuing Activity
For abstract see Volume 1, N69-29735

N69-29752*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
AN OZONE MEASUREMENT IN THE MESOSPHERE AND STRATOSPHERE BY MEANS OF A ROCKET SONDE
Ernest Hilsenrath, Lester Seiden, (Panametrics Inc.) and Philip Goodman (Panametrics Inc.) May 1969 27 p refs Submitted for publication
(NASA-TM-X-63576; X-622-69-210) Avail: CFSTI CSCL 04A

A measurement of the ozone content of the mesosphere and stratosphere was performed, using a parachute sonde released from a rocket. The sonde determines ozone mixing ratio, in situ, as a function of altitude, by means of a sensor containing a chemiluminescent detector. The atmosphere is sampled by self-pumping as the sonde descends on a specially designed high altitude parachute. Calibration of the ozone sensor is accomplished immediately prior to flight by sampling known concentrations of ozone at rates expected during a flight. An ozone profile of approximately 2 km resolution was obtained from 67 km to 18 km. A small secondary peak was measured at approximately 62 km. An ozone mixing ratio maximum of 16 μgram/gram was measured at 34 km, and a concentration peak of 5×10^{12} molecules/cm^3 was measured at 25 km. The estimated error in the measurement between 57 km and 20 km is about $\pm$20%, and about $\pm$50% at the other altitudes. The chemiluminescent sonde-measured profile agrees well with other rocket and balloon observations flown simultaneously with this flight in the altitude regions where the measurements overlap. Author

N69-29760# Miami Univ., Coral Gables, Fla. Inst. of Atmospheric Science.
A NUMERICAL STUDY OF TROPICAL ATMOSPHERIC CIRCULATIONS
Arthur C. Pike Oct. 1968 130 p refs
(Contract F19628-68-C-0144)
(AD-685239; AFCRL-68-0593; SR-2) Avail: CFSTI CSCL 4/1

A time-dependent primitive-equation numerical model in two dimensions, horizontal distance and height, is developed and applied to the study of the general circulation of the tropical troposphere, with particular reference to the inter-tropical convergence zone (ITC), and of the tradewind flow over an eastern subtropical ocean below ca. three kilometers. This model incorporates the effects of buoyant convection, small-scale vertical eddy diffusion and large-scale horizontal diffusion; it is particularly responsive to imposed sea-surface temperatures. The results show that ITC structure is determined mainly by the surface temperature profile, the major updraughts being located, on the average, at the latitudes of highest temperature. Frictional convergence effects may cause the ITC to form temporarily at other latitudes. The sparse trade-wind precipitation of 0.10-0.15cm/day is well-predicted by this model. Author (TAB)

N69-29778# Uppsala Univ. (Sweden). Seismological Inst.
SEISMIC BODY WAVES AND SURFACE WAVES Final Report, 1 Jul. 1963–31 Dec. 1968
Markus Bath Jan. 1969 58 p refs
(Contract AF 61(052)-702; ARPA Order 292)
(AD-685204; AFCRL-69-0128; SR-75) Avail: CFSTI CSCL 17/10

The report gives a review of the activities at the Seismological Institute, Uppsala, under contract AF 61(052)-702 in the interval from July 1963 to December 1968. The report is divided into the following sections: (1) Personnel; (2) Development of the contract project: (a) Higher-mode surface waves, (b) Deep-well and surface-array data, (c) Fundamental-mode surface waves, (d) Body waves; (3) Reports produced; (4) Financial review. Author (TAB)

N69-29786# Bureau of Mines, Washington, D.C.
ELASTIC MODULI OF ROCK AT ELEVATED TEMPERATURES
Carl F. Wingquist Jun. 1969 22 p refs
(BM-RI-7260) Avail: Issuing Activity

The elastic moduli of four types of rock were measured at temperatures ranging from room temperature up to 1500°F. The sonic method was employed to determine the resonant frequencies of the rock specimens and from these frequencies, the elastic moduli were calculated. Data for Young's modulus, shear modulus, and Poisson's ratio are given as a function of temperature for Dresser basalt, Reserve taconite, Jasper quartzite, and Chercoal granite. Young's modulus and the shear modulus decreased with increasing temperature up to about 1200°F and then became relatively insensitive to temperatures from 1200° to 1900°F. Author

N69-29838# Universidade Mackenzie, Sao Paulo (Brazil). Centro de Radio-Astronomia e Astrofisica.
VLF PROPAGATION IN THE LOWER IONOSPHERE Annual Report, Jan. 1968–Jan. 1969
Pierre Kaufmann Jan. 1969 17 p refs
(Contract DA-ARO-D-092-65-G77)
(AD-685468; CRAAM-31) Avail: CFSTI CSCL 20/14

The report contains abstracts of papers published, accepted for publication, or prepared in the course of 1968. TAB

N69-29846# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
COSMIC RAY NM-64 NEUTRON MONITOR DATA FROM KULA, HAWAII Monthly Graphs, Jan.-Dec. 1968
H. Carmichael, J. F. Steljes, and A. Kowalski (Kula, Hawii) Jan. 1969 47 p
(AECL-3282) Avail: Available from Atomic Energy of Can. Ltd., Chalk River: $1.50

Uncorrected and barometer-corrected hourly data from a 3-NM-64 mobile latitude survey neutron monitor stationed at Kula, Maui, Hawaii are given in tabular form for the period from January 1968 to December 1968. Graphs of the corrected data and of the barometric averages are given for the same period. The site is about 1000 m above sea level, and the data are corrected to 66.6 cm Hg. Author

N69-29858# Naval Civil Engineering Lab., Port Hueneme, Calif.
AN ISOSTATIC STUDY OF NORTHERN AND CENTRAL GREENLAND BASED ON GRAVITY VALUES AND AIRBORNE RADAR ICE-THICKNESS MEASUREMENTS
Edmund F. Pawlowicz Mar. 1969 121 p refs
(AD-685237; NCEL-TR-619) Avail: CFSTI CSCL 8/12

The report presents an investigation of glacio-isostatic conditions in northern and central Greenland, using free-air and Bouguer gravity anomalies. For the north, ice-thickness profiles are calculated from 30-MHz airborne radar propagation data and later combined with British North Greenland Expedition (BNGE) gravity yielding approximate Bouguer anomalies. Gravity and seismic ice-thickness results from the Expedition Glaciologique International au Groenland (EGIG) are used in the Bouguer anomaly calculations for central Greenland. Author (TAB)

N69-29878*# Minnesota Univ., Minneapolis. School of Physics and Astronomy.
INTENSITY CORRELATIONS AND SUBSTORM ELECTRON DRIFT EFFECTS IN THE OUTER RADIATION BELT MEASURED WITH THE OGO-III AND ATS-1 SATELLITES
K. A. Pfitzer and J. R. Winckler Apr. 1969 38 p refs
(Grant NGL-24-005-008)
(NASA-CR-101840; CR-136) Avail: CFSTI CSCL 04A

During late December 1966 and January 1967 the elliptically orbiting satellite OGO-3 entered the magnetosphere within 30° of the subsolar point and within 10° of the geomagnetic equator. This permits the measurement of the distance to the magnetosphere boundary, which is a necessary parameter for the Mead model magnetic field calculations. The electron fluxes measured by an electron spectrometer and an ion chamber on OGO-3 are correlated with electron fluxes on the geostationary satellite ATS-1 at the exact time when both satellites are on the same drift shells as calculated from the Mead model magnetic field with separations on local time up to 180°. During quiet times an absolute comparison of the fluxes from 50 to 1000 keV gives a linear relationship indicating agreement of the measurements over a three order of magnitude range of intensities. During substorm increases the ATS-1 measurements have similar profiles but are delayed in time with respect to each other. The observed dealys are smaller for higher energy electrons and larger for greater separations in local time. As an example, the measured delays for 50, 150 and 400 keV electrons on January 11, 1967, when the local time separation was 110°, are 26, 13-17, and 5 minutes, respectively. Author

N69-29942*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
REEXAMINATION OF THE ANOMALOUS ZENITHAL DISTRIBUTION OF THE ATMOSPHERIC MUONS
Kaichi Maeda May 1969 11 p refs
(NASA-TM-X-63579; X-640-69-222) Avail: CFSTI CSCL 03B

An examination of the data from the Utah neutrino detector indicates the presence of internal inconsistencies. This is shown by making comparisons among in situ data only, instead of referring them to the world survey data. The X-process seems, therefore, weakly based, if not unsubstantiated. Author

N69-29979# Hawaii Univ., Honolulu. Radioscience Lab.
AN INVESTIGATION OF ANOMALOUS NIGHTTIME INCREASES IN TOTAL ELECTRON CONTENT AT LOW LATITUDES
Dolores M. L. Young Jun. 1969 117 p refs
(Grants NSF GP-5404; NSF GA-1113)
Avail: Issuing Activity

The anomalous nighttime increases in total electron content measured at Hawaii using the Faraday rotation of VHF signals from geostationary satellites are shown to be real increases in content. From the continuity equation for total electron content for a simplified model of the nighttime ionosphere and the data obtained, it is concluded that a source external to the column of content observed provides the additional ionization required for the content increases and that the mechanism for this source is separate from that which maintains the nighttime ionosphere. A statistical study of the Hawaii content data from September 1964 to September 1968 showed that the content increases exhibit both seasonal and solar cycle dependences. The source of ionization is deduced to have a horizontal westward component of velocity. The occurrence of distinctly different and unusual nighttime content implies that the anomalous nighttime increases can be localized phenomena. Author

N69-30041*# Stanford Univ., Calif. Remote Sensing Lab.
STATISTICAL ANALYSIS OF IR SPECTRA: STANFORD PROGRAMS APPLIED TO USGS SPECTRA IN TECH LETTER NO. 13
10 Nov. 1967 107 p refs
(Grant NGR-05-C20-115)
(NASA-CR-101719; SU-RSL-67-3) Avail: CFSTI CSCL 08G

Results of continuing research involving statistical analysis of the infrared spectra of various rock formations are presented. Samples included felsic, plutonic and volcanic rocks from Mono Craters and mafic volcanic rocks from the Pisgah Crater. These were heated and analyzed using an interferometer spectrometer equipped with an ambient-temperature thermistor bolometer. The spectra were digitized by hand at a 0.1 micron interval from 7.8 to 13 microns and statistically analyzed according to established algorithms. The tabulated results of the spectral analysis, as well as descriptions of several computer programs used in obtaining them, are presented. A.C.R.

N69-30056*# Techtran Corp., Glen Burnie, Md.
MOTION OF THE EARTH'S POLE FROM 1846.0 TO 1891.5, ACCORDING TO OBSERVATIONS PERFORMED AT PULKOVO, GREENWICH, AND WASHINGTON [DVIZHENIYE POLYUSA ZEMLI V 1846.0-1891.5 GODAKH PO NABLYUDENIYAN V PULKOVE, GRINVICHE I VASHINGTONE]
L. V. Rykhlova Washington NASA Jun. 1969 4 p refs Transl. into ENGLISH From Astron. Zh. (Moscow), v. 45, no. 5, 1968 p 1132–1133
(Contract NASw-1695)
(NASA-TT-F-12383) Avail: CFSTI CSCL 08E

Calculation was made of the coordinates of the earth's pole for the period from 1846.0 to 1891.5 from the latitudinal functions observed at Pulkovo, Greenwich, and Washington. The x- and y-components of the motion of the earth are given in graphical form. Author

N69-30067# Institut d'Aeronomie Spatiale de Belgique, Brussels.
VARIATIONS IN ATMOSPHERIC DENSITY NEAR ALTITUDES OF 150 km DEDUCED FROM THE DAMPING STUDY OF SATELLITES [LES VARIATIONS DE LA DENSITE ATMOSPHERIQUE VERS 150 KM. DEDUITES DE L'ETUDE DU FREINAGE DES SATELLITES]
J. Verchaval 1969 42 p refs In FRENCH; ENGLISH summary Submitted for publication
(A-61-1969) Avail: CFSTI

The variations in air density at altitudes near 150 km have been deduced from the orbital data of the satellite 1966-101G during the period from November 1966 till April 1967. Adopting the Nicolet's J_{25D} models, several types of density variations

at 155 km are revealed. They are: (1) a variation with solar activity as well in the daytime hemisphere as in the nightime hemisphere; (2) a suspected seasonal and latitudinal variation which is to be confirmed; (3) a small day-to-night variation with a relative amplitude of 5 to 10 percent; and (4) a very important semiannual variation with density increase of 40 percent between January 1967 and April 1967. The semiannual variation in density observed at 155 km and at higher altitudes is suspected to be related to a semiannual variation of the temperature at a height of 120 km.
Author

N69-30102# Woods Hole Oceanographic Institution, Mass.
SOME ASPECTS OF THE GRAVITY FIELD AND TECTONICS OF THE NORTHERN CARIBBEAN REGION
Carl Bowin [1969] 15 p refs *Its* Contrib. No. 2217
Avail: Issuing Activity

Free air and simple Bouguer anomaly charts and profiles were prepared for the Caribbean region north of 14°N latitude. Free air anomalies of the island arc were generally positive with the exception of small parts of Cuba, Hispaniola, and Barbados. Bouguer anomalies generally indicated large scale mass variations beneath the sea floor in marine observations, and beneath sea level for land observations. Motion studies have indicated strike-slip faulting with underthrusting of the oceanic crust along Cayman Trough and parallel to Puerto Rico Trench. This motion is related to a common motion of a Caribbean crustal block. Uplift of the sediments is greater to the south, because of the compressive forces accompanying the underthrusting of the Lesser Antillean arc by the Atlantic Ocean crust, as suggested by recent seismic reflection profiles.
J.A.M.

N69-30108# Defence Research Board, Ottawa (Canada). Telecommunications Establishment.
ALOUETTE 1: IONOSPHERIC DATA. ALOSYN
1 Jul. 1968 78 p
Avail: CFSTI

The topside sounder synoptic data (Alosyn) from Alouette 1 are presented. Selected ionospheric parameters from Alouette 1 ionograms were tabulated from all sounder data recorded at 15 telemetry stations across the globe. Ionograms demonstrating the tabulated parameters are included.
M. H. E.

N69-30109# Defence Research Board, Ottawa (Ontario).
THE ORIGIN OF THE BAIKAL DEPRESSION
V. V. Lamakin Apr. 1969 29 p Transl. into ENGLISH from Priroda (Moscow), no. 4 p 48–59
(T-504-R) Avail: CFSTI

A geomorphological discussion of the depression which Lake Baikal occupies and the surrounding mountains and forests is presented. The depression, adjacent to the Siberian platform, was characterized by transverse asymmetric morphology, tectonic downwarping, and rapidly accelerating deepening and shifting since its origin in the Tertiary Period. Crustal spreading and collapse proceeding in one direction and significant other signs pointed to a northwestward stretching of the earth's crust in the depression. Forecasting of Baikal earthquakes which occur in the depression, not in the rimming mountains, was accomplished and confirmed in this discussion.
M. H. E.

N69-30111 Kiruna Geophysical Observatory (Sweden).
KIRUNA GEOPHYSICAL DATA, DATA SUMMARY, OCTOBER 1968
L. Liszka, ed. Oct. 1968 32 p
Avail: CFSTI

Polar upper atmosphere geophysical observations for October, 1968 are presented. The Kiruna Observatory is located geographically at 67.8N and 20.4E, and geomagnetically at 65.3N and 115.5E. Geomagnetism, optical aurora, ionospheric ionization, VLF and satellite transmission wave propagation, and cosmic radiation data are given. Comments are included on the techniques for obtaining the following observations: geomagnetic K-indices, magnetic pulsations, three-hourly earth current amplitude values, ionospheric absorption, and normal magnetograms.
E.C.

N69-30119# Scientific Rocket Research Group on Space, Athens (Greece).
DATA OF SOLAR-TERRESTRIAL INTEREST
D. J. Ilias, ed and D. P. Elias, ed. Jan. 1969 19 p
Avail: CFSTI

Routine observations of solar and terrestrial interest collected during the month of January 1969 are presented. Data presented were collected at the following Greek stations associated with the Scientific Group for Space Research: (1) Agia Paraskevi (38° 00′ N, 23° 49′ E); (2) Icaros Athens (37° 58′ N, 23° 45′ E); and (3) Dedalos Larissa (39° 39′ N, 22° 25′ E).
Author

N69-30123 Royal Greenwich Observatory, Herstmonceux (England).
MAGNETIC RESULTS 1959, 1960 AND 1961 (HARTLAND)
1969 176 p refs *Its* Roy. Obs. Bull. No. 146
Copyright. Avail: HMSO 1 £ 10s

Magnetic data tables show: (1) hourly means of magnetic declination west and extreme values; (2) hourly means of horizontal component of magnetic intensity and extreme values; (3) hourly means of vertical component of magnetic intensity and extreme values; (4) K-indices for the year; (5) mean diurnal inequalities of the magnetic elements, all days, international quiet days, and international disturbed days; (6) noncyclic change; and mean monthly and annual values of geomagnetic elements. Also presented are mean annual values for Greenwich from 1818 to 1925, Abinger from 1925 to 1956, and Hartland from 1957 to 1967.
E. C.

N69-30129# Expeditions Antarctiques Belgo-Neerlandaises, Brussels (Belgium).
BELGIUM-NETHERLANDS ANTARCTIC EXPEDITION 1964. IONOSPHERE (GROND STATION KING BAUDOUIN APRIL 1964–JANUARY 1965) [EXPEDITION ANTARCTIQUE BELGO-NEERLANDAISE 1964. IONOSPHERE (BASE ROI BAUDOUIN, AVRIL 1964–JANVIER 1965)]
H. A. Vandevelde 1969 176 p In FRENCH
Avail: CFSTI

The scientific program of the expedition was established in accordance with the directives of the SCAR for the IQSY and included: meteorology, geomagnetism, ionospherics, atmospheric radioactivity, atmospheric electricity, aurorae, geodesy, topography, gravimetry, glaciology, biology and physiology. The 1964 Belgium-Netherlands antarctic expedition consisting of 10 Belgian and 4 Dutch members was commanded by Ing. L. Cabes. The expedition left Antwerp 8 December 1963 on board the M.S. Meggs Dan and disembarked in the King Leopold III Bay 21 January 1964. A new base was constructed in the neighborhood of the old base evacuated in February 1961. As soon as the base was constructed the expedition started the scientific program which was continued till the arrival of the 1965 expedition in January 1965.
Author (ESRO)

N69-30138# Potchefstroom Univ. for Christian Higher Education (South Africa). Cosmic Ray Research Unit.
LATITUDE DEPENDENCE OF CHARGED PARTICLE ALBEDO ESTIMATED FROM BALLOON-BORNE GEIGER TELESCOPES

P. J. Koenig, J. P. Maree, P. H. Stoker, and A. J. van der Walt [1969] 19 p refs
Avail: CFSTI

From the atmospheric depth intensity distributions for a series of balloon flights with standard Geiger telescopes during the IQSY, the total charged particle intensity at the top of the atmosphere was obtained. The resulting charged albedo intensity as function of cutoff rigidity compares well with the estimates obtained from balloon-borne Cherenkov counter and satellite observations for recorders of 0.5g cm $^{-2}$. At high latitudes the percentage of albedo intensity corresponds to Webber's splash albedo intensity, rising to the total (splash + reentrant) albedo intensity from about 55° to 40° invariant latitude. Author

N69-30148# Texas Univ., Austin. Electronics Research Center.
METHODS OF MAGNETOTELLURIC ANALYSIS
William E. Sims and F. X. Bostic, Jr. 7 Jan. 1969 94 p refs
(Contract N00014-67-A-0216-0004; Grants NSF GA-1238; AF-AFOSR-67-766E)
(AD-685130; TR-58; AFOSR-69-0189TR) Avail: CFSTI CSCL 8/7

Magnetotelluric prospecting is a method of geophysical exploration that makes use of the fluctuations in the natural electric and magnetic fields that surround the earth. These fields can be measured at the surface of the earth and they are related to each other by a surface impedance that is a function of the conductivity structure of the earth's substrata. This report describes some new methods for analyzing and interpreting magnetotelluric data. A discussion is given of the forms of the surface impedance for various classes of models, including one, two and three dimensional models. Here, an n dimensional model is one in which the parameters describing the model are functions of at most n space coordinates. Methods are discussed for estimating the strike direction for data that is at least approximately two dimensional. Author (TAB)

N69-30149# National Center for Atmospheric Research, Boulder, Colo.
HUMAN DIMENSIONS OF THE ATMOSPHERE
W. R. D. Sewell Feb. 1968 382 p refs
Avail: Issuing Activity

The need for intensifying social science research to determine specific problems raised by human uses of the atmosphere is discussed, as well as the urgency of adapting, discovering, and using analytical and predictive techniques to reflect the complexity and diversity of these problems and to help in evaluating alternative solutions. The systems approach, input–output analysis, and simulation models of various types are emphasized as having great potential in this area, and several initial attempts at modifying existing models for use in analysis and measurement of impacts caused by weather changes are described. Recommended topics for further research include: planning and decision-making techniques; geographical analysis as a tool in studying human response to weather; ecological, sociological, and political implications; weather modification and legal research; and international legal aspects of weather modification. A.C.R.

N69-30163# Commissariat à l'Energie Atomique, Bruyères-le-Chatel (France).
CALCULATION OF THE SHOCK WAVE IN THE REGION CLOSE TO AN UNDERGROUND NUCLEAR EXPLOSION [CALCUL DE L'ONDE DE CHOC EN ZONE PROCHE D'UNE EXPLOSION NUCLEAIRE SOUTERRAINE (METHODE CADES)]
Francis Supiot and Jacques Brugles Apr. 1969 25 p refs In FRENCH; ENGLISH summary
(CEA-R-3738) Avail: CFSTI

A method is outlined for calculating the characteristics of a shock wave produced by an underground nuclear explosion (pressure, wave velocity, velocity of the medium, energy left in the medium by the shock, etc.). Application to a granitic medium and comparison with results obtained during French nuclear explosions shows good agreement. The advantages of such a method for studying the industrial applications of underground nuclear explosions are stressed. Author (ESRO)

N69-30188# Tehran Univ. (Iran). Inst. of Geophysics.
TELLURIC CURRENT OBSERVATIONS IN TEHRAN DURING THE YEAR 1966
Sep. 1967 50 p
(PUB-44) Avail: CFSTI

Tables are presented detailing telluric current observations in Tehran, Iran for 1966. A previous report is cited for full description of the historical background; site; meteorological conditions; equipment; circuit diagrams; etc., and tabular data only are presented. Tables are presented for the north–south and east–west components of the telluric current potential gradient and diurnal variations are summarized. K.R.G.

N69-30223# Tehran Univ. (Iran). Inst. of Geophysics.
THE TIDAL MEASUREMENTS OF THE CRUST AND THEIR HARMONIC ANALYSIS IN TEHRAN DURING THE YEARS 1962–1966
Nov. 1968 81 p
(Publ-43) Avail: CFSTI

Tables are presented of tidal measurements of the earth's crust and harmonic analyses as recorded in Tehran, Iran during the years 1962 through 1966. Detailed are the observatory site, recording instruments, station coordinates, observation procedure, and methods of computation. K. R. G.

N69-30250# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
ON THE SPEEDY COMPUTATION OF TERRAIN CORRECTIONS DURING GRAVIMETER OBSERVATIONS [OB USKORENNOM VYCHISLENII POPRAVKI ZA RELYEF PRI NABLYUDENIYAKH S GRAVIMETROM]
P. P. Makagonov et al Jan. 1969 12 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Geol. i Razvedka (Moscow), v. 11, no. 1, 1968 p 104–108
(AD-685662; ACIC-TC-1484) Avail: CFSTI CSCL 8/5

The paper is a discussion of the method used to quickly compute terrain corrections during gravimeter observations. Different relief sections around the observation point can be subdivided into three zones. The near zone, within which the earths surface can in many cases be approximated by a polyhedral angle or by an inclined plane. The correction for the relief of this zone depends only on the horizontal position of the point. In the middle zone the value of the correction depends both on the horizontal position of the point and on its absolute elevation. In the more distant zone the value of the correction for relief is practically independent of the horizontal position of the gravimetric point, but depends on its elevation. The computation method and graph method used to compute terrain corrections are explained, with charts showing obtained results. TAB

N69-30251# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
ASTRONOMIC GEODETIC NET OF THE USSR [ASTRONOMO-GEODEZICHESKAYA SET SSSR]
S. G. Sudakov Feb. 1969 17 p Transl. into ENGLISH from Geodez i Kartograf (Moscow), no. 10, 1967 p 18–31
(AD-685661; ACIC-TC-1475) Avail: CFSTI CSCL 8/5

The state geodetic net of the USSR in its present form is a complicated structure. In terms of position it is sub-divided into four classes. The first order triangulations as an astronomic-geodetic net is intended for scientific investigations connected with determination of the earths form and dimensions and for distribution of a single system of coordinates over the entire area of the USSR. The first and second order nets serve as a basis for the development of the subsequent order nets. The third and fourth order nets are the nets of condensation. The first order triangulation is constructed in the form of polygons; the nets of the subsequent orders are continuous; the triangles cover a given area entirely. This work is a concise review of astronomic-geodetic nets in the USSR. TAB

N69-30252# Aeronautical Chart and Information Center, St. Louis, Mo. Linguistic Section.
FUNDAMENTAL LEVELING NET OF THE USSR [OSNOVNAYA NIVELIRNAYA SET SSSR]
I. I. Entin Jan. 1969 11 p Transl. into ENGLISH from Geodez. i Kartograf. (Moscow), no. 10, 1967 p 32-37
(AD-685660; ACIC-TC-1474) Avail: CFSTI CSCL 8/5

This paper deals with the work done toward establishing a leveling net of the USSR. The first catalog of elevations related to the mean Baltic Sea-Black Sea level was published in 1894. Tremendous work on the creation of the main elevation base has been done. The first and second order levelling lines, referred to a single system of elevations, are now located over the entire USSR and form a net securing all the current demands of the USSR national economy and various scientific investigations. TAB

N69-30256# Kiruna Geophysical Observatory (Sweden).
KIRUNA GEOPHYSICAL DATA
Nov. 1968 30 p *Its* Data Summary 68/11
Avail: CFSTI

Current geophysical data related to polar upper atmosphere conditions are presented, based upon measurements carried out at Kiruna Geophysical Observatory, Sweden during November 1968. Continous recordings of the following upper atmosphere parameters were made and tabular and graphic summaries given: geomagnetism, optical aurora, ionospheric ionization, radio wave propagation, and cosmic radiation. K.R.G.

N69-30281# Tehran Univ. (Iran). Inst. of Geophysics.
THE MEASUREMENT OF ATMOSPHERIC ELECTRICITY IN TEHRAN DURING THE YEAR 1967
Oct. 1968 31 p refs
(Publ-45) Avail: CFSTI

Tabulated data are given for the atmospheric electric potential for the year 1967. The tables include the hourly values and the mean hourly values from January to December, and the mean hourly values of the quiet days from January to December. The hours are all referred to the 52° 31' East Meridian Mean Time. B. P.

N69-30300# Norges Geotekniske Institutt, Oslo.
ELECTRO-OSMOSIS: EFFECTS AND APPLICATIONS IN GEOTECHNOLOGY [ELEKTROOSMOSE, VIRKNING OG ANVENDELSE INNEN GEOTEKNIKKEN]
Johan Moum 1967 35 p refs in NORWEGIAN
Avail: CFSTI

Basic processes of electrokinetics are reviewed, including ionic mobility, electrolysis phenomena, electrophoresis, and electric diffusion in double layers. The factors of the electro-osmotic transport equations are briefly examined. Effects and measurements of the permeability coefficient, ground resistance, pore water pressure, and capillary flow are discussed, and the consolidation of data obtained in electro-osmosis are discussed, among them stabilization of steep soil embankments, lowering of ground water levels, stabilization of foundations and soils, and control of side friction on steel pilings. The effects of soil composition are considered throughout. Some examples are given of dimensioning and emplacing of electro-osmosis arrangements. Transl. by K.W.

N69-30303*# Kansas Univ., Lawrence. Engineering Science Div.
RADAR BIBLIOGRAPHY FOR GEOSCIENTISTS
Robert L. Waters Mar. 1968 34 p refs
(Contracts NSR-17-004-003; NASS-7175; Grant NSG-398; Contract USGS-14-08-0001-10848)
(NASA-CR-101707; CRES-61-30) Avail: CFSTI CSCL 08G

A comprehensive source of background information is provided, emphasizing geological, agricultural, geographical, and related interpretations of high-resolution, side-looking airborne radar imagery. Two hundred sixty-six references are cited and indexed, covering a broad spectrum of subjects from applied imagery analyses and interpretations to selected theoretical studies. Author

N69-30327# Scientific Rocket Research Group on Space, Athens (Greece). Scientific Group for Space Research.
DATA OF SOLAR-TERRESTRIAL INTEREST
D. J. Ilias, ed and D. P. Elias, ed. Feb. 1969 22 p
Avail: CFSTI

Information is presented on solar-terrestrial phenomenon, collected from several stations in Greece. The data were collected via satellites, though some optical observations of sunspots are presented. The information is given in graphs and tables. E. H. W.

N69-30333# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
NEUTRAL D REGION CHEMISTRY FOLLOWING HIGH LEVEL IONIZATION IMPULSES
Murray Scheibe Jul. 1968 43 p refs
(Contract N00014-67-C-0141)
(AD-685802; LMSC-N-15-68-1) Avail: CFSTI CSCL 4/1

The changes in the neutral constituents in the D-region following high level ionization pulses, such as those caused by nuclear detonations, is reexamined with regard to the effects of updated rate constants, charged particle reactions and ambient neutral constituents. The major differences from the results of Bransomb and LeLevier are: Longer persistence of the nitrogen atom concentrations; Early formation by charged particle reactions of high levels of nitric oxide, and to a lesser extent, of nitrogen dioxide during the day; The formation of N2O, which has a decay time measured in months. Author (TAB)

N69-30334# Defence Research Board, Ottawa (Ontario). Telecommunications Establishment.
ALOUETTE 1 IONOSPHERIC DATA ALOSYN
1 Jul. 1968 142 p
Avail: Issuing Activity

Selected ionospheric parameters obtained from Alouette 1 ionograms are tabulated. Alouette topside sounder data (Alosyn) was recorded by telemetry stations throughout the world for the period 1 August 1964 to 15 August 1964. P.C.S.

N69-30341# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
EARTH AND ATMOSPHERE SHINE BACKGROUNDS
Alan J. Grobecker Nov. 1968 39 p
(Contract DAHC15-67-C-0011)
(AD-684846; N-592) Avail: CFSTI CSCL 4/1

The report reviews current knowledge of earth and atmosphere shine background radiation. Field measurements accomplished up to 1968 are summarized with references, quoted measurement data and effective spectral radiance values. The relation of the several parameters which contribute to the radiation emissions is briefly summarized. Author (TAB)

N69-30348# Kiruna Geophysical Observatory (Sweden).
KIRUNA GEOPHYSICAL DATA Data Summary, Jan.–Mar. 1968
L. Liszka, ed. Mar. 1968 70 p *Its* Data Sum. 68/1–3
Avail: CFSTI

Summaries, charts, and tables show polar upper atmosphere geophysical data. Observations are given on: magnetic K-indices, ionospheric absorption, earth current, magnetic pulsations, cosmic noise absorption, normal magnetograms, and riometer recordings. E.C.

N69-30362*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
EARTH RESOURCES PROGRAM: PROCEEDINGS OF GROUND TRUTH SESSION Final Report
Nov. 1967 179 p refs
(NASA-TM-X-61729) Avail: CFSTI CSCL 14B

Ground truth capabilities and requirements are discussed including their application to future orbital space missions. The following topics are presented: (1) existing ground truth capabilities, (2) measurements required and measurements currently being made, (3) equipment now being used and future requirements, (4) ground sites now supported and type of support, (5) recommendations relative to the Earth Resources Aircraft Program concerning ground truth, and (6) extrapolations of the above topics for short term (10 to 15 days) and long term (1 to 2 years) orbital missions. Ground truth applied to agriculture, support radar, and oceanographic features is also discussed. Author

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N69-29003 Stanford Univ., Calif.
HOLOGRAPHIC IMAGING THROUGH A RANDOMLY INHOMOGENEOUS MEDIUM
Jack Donald Gaskill (Ph.D. Thesis) 1968 118 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-222

The resolution of images formed from turbulence-degraded holograms is analyzed for gaussian and exponential refractive-index structure function models, first by a geometrical-optics method and then by Schmeltzer's series-expension method, under the assumption that the random log-amplitude and phase perturbations across the entrance pupil of the recording apparatus are locally stationary processes with gaussian statistics. Both long and short exposures are treated. It is shown that the resolution of turbulence-degraded holographic images is governed primarily by a function $m^2(r_1)$, for which both analytical expressions are derived and results of experimental measurements are given. The quantity $m^2(r_1)$ is found to depend on the optical wave number, the length of the propagation path, the refractive-index structure constant C^2_N, and the correlation length of the refractive-index perturbations. Dissert. Abstr.

N69-29006 Stanford Univ., Calif.
AN INTERFEROMETRIC STUDY OF THE POLARIZATION OF TWO RADIO SOURCES AT A WAVELENGTH OF 9.8 CENTIMETERS
George Samuel Downs (Ph.D. Thesis) 1968 200 p
Avail: Univ. Microfilms: HC $9.00/Microfilm $3.00 Order No. 69-214

A two-element radio interferometer has been used to map the distribution of polarized radiation in the radio sources Taurus A and Cassiopeia A, both supernova remnants. The discussion of these measurements includes a chapter on the theory of aperture synthesis using a wide-band interferometer and on the theory of polarization measurements. A description of the instrument is given, followed by a discussion of the measurement procedures and the data reduction. This distribution of linear polarization over Taurus A was measured with a synthesized beam having half-power widths of 1'.55 North-South and 3'.3 East-West. A comparison of the radio and optical polarized brightness suggests that at very short wavelengths, depolarization occurs strongly in the northwestern part of the source, and that at longer wavelengths the depolarization is more uniformly distributed. The distribution of linear polarization over Cassiopeia A shows that strong depolarization occurs throughout the source between 1.55 cm and 9.75 cm wavelength. Dissert. Abstr.

N69-29041# Illinois Univ., Urbana. Dept. of Civil Engineering.
A TREATISE ON ANALYTICAL PHOTOGRAMMETRY
Giuseppe Inghilleri (Politechnico di Torino, Italy) Sep. 1968 203 p *Its* Photogrammetry Ser. No. 10
(PB-182618) Avail: CFSTI CSCL 08B

The document consists of lecture notes from a course in analytical photogrammetry. It concerns the analytical or semianalytical operations pertaining to the formation of models, strips or blocks of strips, and the criteria by which it is possible to evaluate the thoretical precision of the various operations. These criteria are valid for establishing comparison amongst the processes performed under different conditions or amongst different processes, but not useful to obtain the actual precisions which can be reached. USGRDR

N69-29089 University of Southern Calif., Los Angeles.
WRITING PUSHDOWN ACCEPTORS
George Edward Mager (Ph.D. Thesis) 1968 80 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 69-628

This paper introduces a new automaton, called a writing pushdown acceptor (abbreviated WPDA), and investigates some of its properties. A WPDA is essentially a two-way pushdown acceptor that can write on its input tape. A number of results about WPDA are established. In particular, it is shown that: (1) Each set accepted by a WPDA is accepted by some WPDA that halts for all inputs. (2) The family of sets accepted by deterministic WPDA forms a Boolean algebra of sets, contains the family of context sensitive languages, and properly contains the family of sets accepted by deterministic two-way pushdown acceptors. (3) The family of sets accepted by (deterministic WPDA is contained in the

family of sets accepted by (deterministic) stack acceptors. In the deterministic case, the containment is shown to be proper.
Dissert. Abstr.

N69-29101# Naval Radiological Defense Lab., San Francisco, Calif.
ELECTRON X-RAY AND GAMMA-RAY MEGARAD DOSIMETRY WITH COLORED PLASTIC
Norman Goldstein and William G. Miller 3 Feb. 1969 19 p refs
(AD-684772; USNRDL-TR-69-7) Avail: CFSTI CSCL 18/4

Two Cinemoid Color Mediums, purple and bright rose, were calibrated as radiation detectors. The dyed plastic undergoes optical changes in the visible spectrum for exposures between 10 to the 5th and 7th power R. Measurement of optical change was simplified with the use of densitometer instead of spectrophotometer readout. The changes obtained with the densitometer color filters were only slightly decreased from those obtained with the spectrophotometer set at the wavelength of optimum color change. Moisture content had some effect on both Cinemoids whereas oxygen content effected only the exposure of the purple Cinemoid. The bright rose Cinemoid was found useful for measuring pulsed and steady-state electron exposures and for measuring gamma-ray exposure in a mixed gamma ray-neutron field. Author (TAB)

N69-29102# Illinois Univ., Urbana. Dept. of Civil Engineering.
GRID PLATE CALIBRATION
R. C. Malhotra Jun. 1968 35 p refs *Its* Photogrammetry Ser. No. 19
(PB-182728) Avail: CFSTI CSCL 14B

To achieve an optimum analytical photogrammetric system, it becomes necessary to attain as high an accuracy in the coordinate measurements on comparators as is practicable. Comparators are normally adjusted by the manufacturer to meet a particular level of accuracy when used in accordance with the manufacturer's specification. However, by proper calibration of the instrument it is possible to enhance the obtainable accuracy in the comparator coordinate measurements. The use of grid plates of high and known precision is a prerequisite for such a comparator calibration. The purpose, mathematical basis, computer program, and results of a numerical example of a method of grid-plate calibration is presented herein. Author (USGRDR)

N69-29104# Bettis Atomic Power Lab., Pittsburgh, Pa.
PROGRAMMED DENSITOMETER: AUTOMATIC RADIOGRAPH INTERPRETER
K. D. Kirk and E. J. Wargo Jan. 1969 55 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-769) Avail: CFSTI

An automatic radiograph interpreter, designated the programmed densitometer, has been developed to inspect radiographs of plate-type zoned nuclear reactor fuel. A photo-resistive detector is used to sense the radiographic film density; the signal is then digitized, and fed into a small digital data processor for analysis. The same processor is used to direct initial gage setup for each radiograph, to control film motion through the gage, and to print an inspection record. Over 1800 radiographs were processed through the programmed densitometer and checked manually. No radiographs indicating rejectable product were accepted, and over 97 percent of the acceptable radiographs were accepted by the densitometer. It is estimated that this acceptance level would be increased to over 99 percent by reradiographing and reinspecting those radiographs that were rejected. Author (NSA)

N69-29107# Stanford Univ., Calif. Electronics Labs.
OPTIMIZATION OF UNMANNED DATA COLLECTION SYSTEMS
Jon Arthur Jenny Dec. 1968 130 p refs
(Grant NSF GA-1195)
(PB-182747; SU-SEL-69-069; TR-3433-2) Avail: CFSTI CSCL 14C

The thesis develops a performance factor for PCM multiplex systems which relates multiplexer reliability and flexibility to the data formating requirements and operating constraints of data collection systems. Rules are established for selecting the best type of multiplexer for any specific application and an example is given. The thesis also deals with the interrelationships between the various subsystems of an unmanned data collection system. When the cost of power is specified, an optimum combination of multiplexer complexity, transmitter power and antenna size can be computed. This solution is optimum in the sense that it has the lowest total cost of the available alternatives. The required computer programs are described and their application to a specific example is discussed.
Author (USGRDR)

N69-29111 Stanford Univ., Calif.
EFFICIENT HOLOGRAPHY USING TEMPORAL MODULATION
Albert Macovski (Ph.D. Thesis) 1968 166 p
Avail: Univ. Microfilms: HC $7.80/Microfilm $3.00 Order No. 69-258

A method of holography is presented which allows efficient use of limited number of recording elements in the hologram recording plane. A concept is introduced of separating the desired image terms temporally so that no increase in spatial frequency response is required. The separation is achieved by offsetting the image terms on a temporal frequency carrier so that filtering is accomplished by an electrical bandpass filter. The reference signal, rather than being spatially offset, is offset in frequency by an amount ω using a phase modulator or a single sideband modulator. In order to provide the required temporal filtering, the hologram recording device must be capable of preserving temporal variations of intensity, a capability not afforded by photographic film. A television camera is used to measure the intensity versus time at each point in the hologram plane. Dissert. Abstr.

N69-29136*# Techtran Corp., Glen Burnie, Md.
THE USE OF THE EARTH AS A SELENOGRAPHIC LINK FOR LUNAR PICTURES OBTAINED FROM OUTER SPACE
V. V. Shevckenko Washington NASA Jun. 1969 13 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 6, no. 3, 1968 p 924–932
(Contract NASw-1695)
(NASA-TT-F-12340) Avail: CFSTI CSCL 14E

The measurement of the position of the earth disk in relation to the lunar limb may serve as one means for an independent selenographic link for pictures of the far side of the moon. Methods of the determination are examined in the article, in which basically the information contained in the picture itself is employed as initial data. An example of the applications of the method described is cited. According to a picture obtained by the space vehicle "Lunar Orbiter", the selenographic coordinates for the point of photography were determined with an accuracy of $\Delta\beta = \pm 25'$, $\Delta\lambda = \pm 15'$. A grid of selenographic coordinates with a calculated accuracy of $\Delta\beta = \pm 15'$, $\Delta\lambda = \pm 10'$ been applied to a moon map. Author

N69-29153*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DESIGN OF AN ELECTRONICALLY SCANNED STAR SENSOR WITH DIGITAL OUTPUT

Aaron J. Ostroff and K. C. Romanczyk Washington Jun. 1969 37 p refs
(NASA-TN-D-5281) Avail: CFSTI CSCL 14B

A technique for detecting the change in position of a star on the focal plane of a telescope is described. In this technique an image dissector is used to scan the focal plane and to generate position information. Both theoretical and experimental data are presented. The theoretical analysis contains information on signal-to-noise ratio and relationships between star magnitude, system stability, and sweep frequency. Statistical methods are included for determining the standard deviation for detecting any signal pulse, and for calculating the error involved for one or for several measuring periods. The experimental data contain information on the variation of system stability with star magnitude as functions of sweep frequency, threshold level, and averaged data. All testing is for a simulated 3 meter diameter telescope operating at f/100. Results show that for a triangular sweep frequency of 100 hertz and a star magnitude of +10, the system is stable to within ±26.4 nanoradians. This represents a system signal-to-noise ratio of 370. Other results indicate that the system is linear within ±0.6 percent of best straight line over a total field of view of ±9.76 milliradians. Author

N69-29182 Stanford Univ., Calif.
LOW-LIGHT-LEVEL LIMITATIONS OF SILICON JUNCTION PHOTODETECTORS
Joseph Stephen Brugler (Ph.D. Thesis) 1968 90 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-201

The properties of silicon junction photodetectors have been investigated with the goal of improving low-light-level performance of a reading aid for the blind. This application requires an image-forming mosaic of photodetectors, which may be conveniently fabricated by use of integrated circuit technology. Solid-state imaging is particularly attractive because of the low resolution (100 to 200 elements) needed for the reading-aid system. Attention is focused upon photodetector operation utilizing the charge-storage technique, because of the usefulness of this method in increasing the signal level in scanned image applications. The signal and noise transmission properties of the basic charge-storage circuit are analyzed, with the assumption of an ideal switching element. The primary contributors to output uncertainty are found to be dark current and its associated 1/f noise because of the lowpass nature of the circuit. Dissert. Abstr.

N69-29196*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMAL ELECTROMOTIVE FORCE CHANGE FOR 87PT13Rh/PT THERMOCOUPLES IN 1530 K, 10 TO THE MINUS 8 TORR ENVIRONMENT FOR 3700 HOURS
Andrew J. Szanisz lo Washington Jun. 1969 24 p refs
(NASA-TN-D-5287) Avail: CFSTI CSCL 14B

The thermal-emf change for 87Pt13Rh/Pt thermocouples was determined by recalibrations in air after 3700 hours exposure to a low-impurity environment with a temperature of 1530°K and a nitrogen equivalent pressure of 3×10^{-8} torr. Wire size was 0.05 cm (0.020 in.), with two-hole, high-purity alumina (99.5 percent) as the insulator. The range of the thermal-emf changes was −2.0° to −3.6°K (average value, −2.8°K). Wire-impurity concentration along the wire was determined by emission spectrographic analysis, which showed iron to have the highest concentration increase at the junction and the largest concentration gradient near the junction. The change in the ratio of resistance at 300°K to the resistance at 4.2°K was determined for samples of the platinum-wire leg, and test-induced grain-structure changes determined with photomicrographs. Author

N69-29201# Maryland Univ., College Park. Dept. of Aerospace Engineering.
ADVANCES IN HOT-WIRE ANEMOMETRY Final Report
W. L. Melnik ed. and J. R. Weske ed. Jul. 1968 286 p refs
Presented at the Intern. Symp. on Hot-Wire Anemometry, College Park, Md., 20-21 Mar. 1967
(Grant AF-AFOSR-1295-67)
(AD-676019; AFOSR-68-1492) Avail: CFSTI CSCL 14/2

Conference papers are presented on the theory and practice of hot wire anemometry, and on significant applications of hot wire techniques as a diagnostic tool. For individual titles, see N69-29202 through N69-29221.

N69-29202# Johns Hopkins Univ., Baltimore, Md.
SHOULD WE STILL USE HOT WIRES?
Leslie S. G. Kovasznay *In* Md. Univ. Advan. in Hot-Wire Anemometry Jul. 1968 p 2–11 (See N69-29201 16-14)
Avail: CFSTI

The advantages of hot-wire anemometry in measuring fluctuating velocity fields are discussed and related to three other existing methods. Basic varieties of hot-wire anemometers, which consist of probes, associated electrical circuitry, and signal processing equipment, are also briefly discussed. The probes themselves may be bare wires or hot film; a new configuration, the cooled probe, is also being utilized in which fluid is pumped through a minute-sized pipe to provide cooling against very hot flows. The problems associated with each of these techniques are outlined, and system performance is evaluated in various applications. It is concluded that the advent of newer, more complex equipment has not caused the obsolescence of hot-wire anemometry for measuring fluctuating, turbulent, and unsteady flows. A.C.R.

N69-29203# National Bureau of Standards, Washington, D.C.
EARLY DEVELOPMENTS IN HOT-WIRE ANEMOMETRY AT NBS AND A LOOK AT SOME ELSEWHERE
G. G. Schubauer *In* Md. Univ. Advan. in Hot-Wire Anemometry Jul. 1968 p 13–24 refs (See N69-29201 16-14)
Avail: CFSTI

The evolution of hot-wire anemometry during the 1920's is briefly discussed as related to measurement of wind tunnel turbulence and speed fluctuations. The problems in developing efficient equipment and methodology are also briefly treated. It is emphasized that compensation for lag by electrical means enabled the anemometer to become a useful and productive instrument in the area of turbulence measurement and in other applications where lag would otherwise present an obstacle. Another important development contributing to its versatility was the use of slanted wires, in contrast with wire placement normal to the direction of the mean velocity. In this way, measurement of cross-stream components of velocity fluctuations and shearing stress was made possible. Significant improvements were also effected in the 1940's with a portable turbulence measuring system developed by the National Bureau of Standards, and in the application of hot-wires for fluctuation-type measurements in supersonic flow. A.C.R.

N69-29204# Maryland Univ., College Park.
EARLY DEVELOPMENTS OF HOT-WIRE ANEMOMETRY IN THE NETHERLANDS
J. M. Burgers *In its* Advan. in Hot-Wire Anemometry Jul. 1968 p 25–28 (See N69-29201 16-14)
Avail: CFSTI

Early uses of hot-wire anemometry in the 1920's are discussed, beginning with its application to turbulence research in experimental aerodynamics. Resulting information was obtained on the characteristics and velocity distribution of boundary layer flow. Later use of the instrument for studying velocity fluctuations is also

treated, emphasizing observations made on the correlation between these fluctuations at different points. The development of amplifier instrumentation and the experimental difficulties encountered in the general use of hot-wire anemometers complete the discussion. A.C.R.

N69-29205# Computer Command and Control Co., Washington, D.C.
EARLY (1944-1952) HOT-WIRE ANEMOMETER DEVELOPMENTS AT THE NACA LEWIS RESEARCH CENTER
Herman H. Lowell *In* Md. Univ. Advan. in Hot-Wire Anemometry Jul. 1968 p 29–37 refs (See N69-29201 16-14)
Avail: CFSTI

A brief historical review of hot-wire anemometry development during the early post-World War 2 years is presented, insofar as the use of this instrument in jet engine development is concerned. Although incapable of providing engineering data of sufficient accuracy for the worst combinations of conditions, equipment was developed which usually gave local instantaneous and mean mass flow data within inlets and at many points throughout the engine. It was frequently useful in providing direction of flow, pressure, and effective temperature, as well as for application in combinations of conditions involving air total temperatures below 300°C. The development and benefits accrued by the use of thin film and cooled tube instruments are also treated. A.C.R.

N69-29206# Martin Co., Baltimore, Md. Research Inst. for Advanced Studies.
SIGNAL INTERPRETATION IN HIGH-SPEED ANEMOMETRY: A REVIEW
Mark V. Morkovin *In* Md. Univ. Advan. in Hot-Wire Anemometry Jul. 1968 p 38–51 refs (See N69-29201 16-14)
Avail: CFSTI

The problems of signal interpretation in terms of fluid-mechanical variables and minimizing observation and signal processing time are discussed, as well as the associated errors. It is suggested that the need to extend the methods into the rarified regime and to incorporate newer information of the underlying steady-state heat transfer law can be met by utilizing the direct-sensitivity approach in conjunction with computers. The approximation allowable for fluctuation measurements (as contraste to the more demanding steady-state measurements) can then be determined. The entropy, vorticity, and sound modes are exemplified. The direct-sensitivity approach is outlined, and its limitations discussed. Finally, the technique of the fluctuation diagrams is illustrated in the case of the determination of supersonic Reynolds stress and heat flux. Author

N69-29213# Purdue Univ., Lafayette, Ind. School of Civil Engineering.
MEASUREMENTS OF AEROSOLS BY HOT-WIRE ANEMOMETRY
Victor W. Goldschmidt and Michael K. Householder *In* Md. Univ. Advan. in Hot-Wire Anemometry Jul. 1968 p 134–152 refs (See N69-29201 16-14)
Avail: CFSTI

A hot-wire anemometer was modified for measuring aerosol size distribution and concentration in turbulent flows. The sampler circuit included an electronic filter, amplifier, amplitude triggering device, and an electronic counter. The cooling signal due to particle impaction is analyzed with respect to amplitude and frequency distribution. A linear relationship between particle size and cooling signal peak value was found by two different methods and verified. Even though the results were not completely unquestionable, the system lends itself for the determination of aerosol concentration, size distribution and impaction coefficients on the hot filament collector. Author

N69-29215# Naval Ordnance Test Station, Pasadena, Calif.
OPERATING CHARACTERISTICS OF SOME HOT FILM VELOCITY SENSORS IN WATER
A. G. Fabula *In* Md. Univ. Advan. in Hot-Wire Anemometry Jul. 1968 p 167–193 refs (See N69-29201 16-14)
Avail: CFSTI

Quartz-coated platinum film velocity sensors of several forms and one form of thermistor film sensor were used with constant temperature bridges in a towing tank. Sensor contamination was a negligible problem, but frequent recalibration was essential to detect sensor film deterioration. A circular voltage ripple began at a sensor cylinder Reynolds number of about 60, based on free-stream kinematic viscosity. Both the ripple and a false noise signal component at higher speeds appeared to be due to heat transfer fluctuations arising in the region of separated flow expected for such high sensor Reynolds numbers. Grid turbulence measurements were used to compare frequency response of various sensors, using as standard the measurements with sensors whose response was concluded to be flat over the test frequency range. The preliminary results showed some cases of appreciable frequency response drop off. A preferred way of assigning the exponent in the generalized King's law expression, fitted to the steady-state calibration curves of bridge output voltage versus flow speed, was found to be a derivative technique. In one case, this technique showed that in fact the exponent changed abruptly at certain speeds. Author

N69-29216# Boeing Scientific Research Labs., Seattle, Wash.
RECENT DEVELOPMENTS IN HOT-WIRE TECHNIQUES
O. H. Wehrmann *In* Md. Univ. Advan. in Hot-Wire Anemometry Jul. 1968 p 194–202 refs (See N69-29201 16-14)
Avail: CFSTI

Improvements in the hot-wire technique are concerned with an increase in the overall frequency response of the whole anemometer, in order to measure smaller flow elements, and in a reduction of the overall noise level, in order to measure lower intensities. One method of increasing the frequency response of the wire consists of making the actual mass of the wire as small as possible. Whiskers coated with a very thin nickel sheet were successfully used to reduce the time constant of the sensing element. To reduce the noise level of the electronic equipment, a nitrogen-cooled amplifier was built, and a reduction of the noise level in the order of 16 dB was found. The stability problem of the feedback system for the constant temperature mode was analyzed and led to a better understanding of the control system. Stability and frequency response were largely improved. Author

N69-29217# Colorado Univ., Boulder. Dept. of Aerospace Engineering Sciences.
NONLINEAR CONTROL THEORY FOR CONSTANT-TEMPERATURE HOT-WIRE ANEMOMETERS
Peter Freymuth *In* Md. Univ. Advan. in Hot-Wire Anemometry Jul. 1968 p 203–218 refs (See N69-29201 16-14)
(Contract Nonr-1147(10))
Avail: CFSTI

The linear feedback control theory for constant-temperature, hot-wire anemometers was extended to the nonlinear case which can be applied to large velocity fluctuations. Calculations using a second order approximation were made for velocity fluctuations as large as ±80% of the mean velocity. The theory can be extended to higher order approximations. The square wave test for optimizing the frequency response of the anemometer is briefly considered for large amplitudes, and a brief comparison of constant-temperature and constant-current anemometers is given. Author

N69-29219# LTV Aerospace Corp., Dallas, Tex.
COMPENSATING HOT-WIRE SYSTEM FOR LOW PRESSURE AND VELOCITY DIFFERENCE APPLICATIONS
C. J. Stalmach, Jr. *In* Md. Univ. Advan. in Hot-Wire Anemometry Jul 1968 p 244–250 refs (See N69-29201 16-14)
Avail: CFSTI

A system is described which consists of two hot wires, one of which provides the error signal for a feedback controlled power amplifier. The feedback maintains one wire at a constant temperature and also provides the same current to the other hot wire. The two hot wires form two arms of a four-arm bridge, and the primary output is across this bridge. This device has proven to be very useful in resolving low velocities in a low pressure environment and while positioned near a cool wall where radiation of the wire can be a problem. For this application, the compensating wire is shielded from the flow but can sense the wall and is at the same pressure. By removing the shield, the system can be used to accurately resolve the difference between two similar flows. Author

N69-29220# Maryland Univ., College Park.
MEASURING THE FREQUENCY RESPONSE OF CONSTANT TEMPERATURE AND CONSTANT CURRENT HOT-WIRE SYSTEMS
H. P. Grant *In its* Advan. in Hot-Wire Anemometry Jul. 1968 p 251–257 (See N69-29201 16-14)
Avail: CFSTI

Techniques for measuring the frequency response of hot-wire systems are briefly discussed. It is concluded that the square wave electronic technique of frequency response measurement will provide accurate results if used with great care. Pitfalls exist in the method however, and a primary aerodynamic test technique is recommended. An eddy shedding probe as a standard test method is suggested as a device to test the hot-wire circuits themselves and to verify the performance of the built-in square wave calibrator circuits. Several commentaries on the need for a standardized method of frequency response measurement and approaches to establishing one are also included from other contributors to the conference. A.C.R.

N69-29221# Thermo-Systems, Inc., St. Paul, Minn.
PRACTICAL EXTENSIONS OF ANEMOMETER TECHNIQUES
Leroy M. Fingerson *In* Md. Univ. Advan. in Hot-Wire Anemometry Jul. 1968 p 258–275 refs (See N69-29201 16-14)
Avail: CFSTI

Extending anemometer techniques to new applications depends heavily on system performance and data reduction techniques. In addition to frequency response and signal to noise ratio of the system, overall accuracy, long term stability, and selection of sensor types are important to measurement success. These items are related to new applications such as liquid flow, total mass flow, high temperature gases, and large scale turbulence. Author

N69-29222 Polytechnic Inst. of Brooklyn, N.Y.
IMAGE STORAGE AND RECONSTRUCTION IN VOLUME HOLOGRAPHY
Dorian Kermisch (Ph.D. Thesis) 1968 85 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-16250

The problem is solved of the propagation of a plane electromagnetic wave incident on a sinusoidally modulated dielectric slab, and transverse electric with respect to the boundary surfaces, in the case when Maxwell's equations are uncoupled. These results are used to analyze the sensitivity of the reconstructed image to changes in the orientation and wavelength of the read-out beam, and its dependence on the different hologram parameters. Image formation in thin-film holography is treated by means of Green functions for the general case of three-dimensional objects and wide viewing angles. This treatment includes the influence of the film on image resolution, magnification by image recording and reconstruction with different frequencies, and a discussion of methods of image separation which do not introduce distortion in the wide angle case. Dissert. Abstr.

N69-29248# Boeing Co., Seattle, Wash.
DEVELOPMENT OF A PRESSURE TRANSDUCER WITH A SHORT RESPONSE TIME BASED ON STRAIN WIRES FOR MEASUREMENTS AT LOW PRESSURES
H. P. Kabelitz et al Jan. 1968 24 p refs Transl. into ENGLISH from German
(Y-23) Avail: CFSTI

The development, preparation, and operation of a pressure transducer, based on strain wires which are imbedded in an elastic insulation material, are presented. The transducer is particularly suitable for measurements in shock wave wind tunnels, because it has a very short rise time (<1 msec), and its sensitivity is combined with a high overload tolerance. The application of the transducer is shown by measurements in the gun tunnel. Author

N69-29249 Pennsylvania Univ., Philadelphia.
A DUAL INPUT SELF-OPTIMIZING FILTER WITH APPLICATIONS TO HYBRID NAVIGATION SYSTEMS
Hyman James Rome (Ph.D. Thesis) 1968 325 p
Avail: Univ. Microfilms: HC $14.65/Microfilm $3.00 Order No. 69-162

This dissertation describes a dual-input self-optimizing digital filter consisting of two sets of basic filters which may be orthogonal or simply linearly independent. The analysis can be extended to more than two inputs. The output of the filter is the weighted sum of the outputs of the basic filters. First consider the case where the inputs are zero mean random processes. The two useful signal inputs are related to each other by a known linear transformation, and the additive noise associated with each signal are uncorrelated with each other and the useful signal; also, one of the uncorrupted signals is the desired output. It is shown that under such conditions optimization of the filter in the mean square sense can be accomplished using the input information content only. The optimization process involves measurements of the covariance matrix of the outputs of the basic filters as well as the cross-correlations between the desired output and the outputs of the basic filters. Dissert. Abstr.

N69-29307*# National Aeronautics and Space Administration, Washington, D. C.
INVESTIGATION OF A GAS DISCHARGE PRODUCED BY MICROWAVES AND BURNING FREELY IN SPACE [UNTERSCHUNG EINER DURCH MIKROWELLEN ERZEUGTEN FREI IM RAUM BRENNENDEN GASENTLADUNG]
M. Schwertl May 1969 31 p Transl. into English from Inst. Franco-Allemand Rept. T/32/64
(NASA-TT-F-12231; T/32/64) Avail: CFSTI CSCL 14B

The experimental arrangement of a discharge of gas contained under reproducible pressure in a glass receptacle, and set off by concentrated 3.2-cm waves produced by a pulsated X-band generator, is described. The discharge is examined as to spatial expansion, pressure range of burning, and ionization process. The electrical field strength and the power output within the discharge area are calculated. An arrangement for measuring temperature increases of the gas in the discharge area is given. Mean gas temperature was up to 250°C. Author

N69-29331*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EMPIRICAL OBSERVATIONS ON THE SENSITIVITY OF HOT CATHODE IONIZATION TYPE VACUUM GAGES
Robert L. Summers Washington Jun. 1969 47 p refs
(NASA-TN-D-5285) Avail: CFSTI CSCL 14B

A study of empirical methods of predicting the relative sensitivities of hot cathode ionization gages is presented. Using previously published gage sensitivities, several rules for predicting relative sensitivity are tested. The relative sensitivity to different gases is shown to be invariant with gage type, in the linear range of gage operation. The total ionization cross section, molecular and molar polarizability, and refractive index are demonstrated to be useful parameters for predicting relative gage sensitivity. Using data from the literature, the probable error of predictions of relative gage sensitivity based on these molecular properties is found to be about 10 percent. A comprehensive table of predicted relative sensitivities, based on empirical methods, is presented. Author

N69-29362*# Fairchild Stratos Corp., Manhattan Beach, Calif.
CALIBRATABLE PRESSURE SWITCH (SOLID STATE) Final Report
Stuart H. Brown 22 Nov. 1967 53 p refs
(Contract NAS8-11730)
(NASA-CR-61808; ER-350-4) Avail: CFSTI CSCL 14B

The design and development of a solid state differential pressure switch is presented. The initial requirements included dual output elements, each with a nominal setpoint of 20.5 psid. Setpoints were to be individually adjustable within 2.5 psi and with a deadband of 0.15 to 0.50 psi under environmental conditions. The calibration capability was to be an independent function. Environment included operation from −100°F to 165°F at vibration levels to 50 g's. Initial efforts were based on interrupting the light source to a photosensitive semiconductor. They were discontinued in favor of an approach which employed semiconductor strain gages attached to a force beam. Temperature compensation problems and re-evaluation of the specification requirements indicated a return to the initial design and modifications. Author

N69-29423 Stanford Univ., Calif.
AN EXPERIMENTAL AND ANALYTICAL INVESTIGATION OF SHOCK-WAVE REFLECTION IN A CHEMICALLY RELAXING GAS
Ronald Kent Hanson (Ph.D. Thesis) 1968 151 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 69-228

The normal reflection of a shock wave from a shock-tube end wall is studied analytically and experimentally for a chemically relaxing diatomic gas. The pressure exerted on the end wall during the reflection process is obtained analytically by means of inner and outer asymptotic solutions. Knowledge of the pressure solution enables computation of the time evolution of all thermodynamic properties adjacent to the end wall; these calculations typically consume less than one minute of computing time. The results agree closely with those obtained from more exact calculations which require several hours of computing time. A fast-response pressure gauge with a risetime of .2 μsec and a useful recording time of up to 14 μsec is used to measure end-wall pressure histories in pure N_2 for incident shock speeds ranging from 4 to 7 km/sec. Dissert. Abstr.

N69-29428* TRW Systems Group, Redondo Beach, Calif. Mechanical Products Div.
INSTRUMENT UNIT COOLANT PUMPS Final Report
W. V. Edwards 1 May 1968 280 p refs
(Contract NAS8-11578)
(NASA-CR-61871; ER-7273) Avail: CFSTI CSCL 14B

Engineering drawings are presented for the pump assembly consisting of an electrical drive motor and a pump element, for the thermal conditioning system in the instrument unit of the Saturn 1B and 5 launch vehicles. Parts, processes, and modifications are briefly described. N.E.N.

N69-29454 Johns Hopkins Univ., Baltimore, Md.
RAMAN SCATTERING EXPERIMENTS IN STRONTIUM TITANATE
Donald Charles O'Shea (Ph.D. Thesis) 1968 155 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 68-16458

The Raman spectrum of $SrTiO_3$ has been studied between 15°K and 573°K. The spectra were obtained with a modern Raman spectroscopy system consisting of a laser source, a tandem spectrometer and a photoelectric detector. The domains of the low temperature structure ($T < 110$°K) of $SrTiO_3$ have been probed with a laser beam focused to a diameter of less than 50 microns. No contribution to the low temperature spectrum of $SrTiO_3$ could be traced to domain walls. The observed spectrum appears to be due to the bulk crystal. The crystal exhibits a net birefringence or optical activity despite the complex domain patterns which can rotate a polarized beam as it passes through the crystal. Measurements have been made of the temperature dependence of several features of the low temperature Raman spectrum including some sharp low temperature lines of unknown origin. Dissert. Abstr.

N69-29458 Boeing Co., Seattle, Wash. Office of International Operations.
IMPACT PRESSURE MEASUREMENTS IN HYPERVELOCITY, LOW DENSITY ARC HEATED FLOW
K. Kindler Dec. 1968 35 p refs Transl. into ENGLISH of DVL Report DLR-FB-68-42
(B-838; DLR-FB-68-42) Avail: CFSTI

Results of measurement with cooled hemispherical and flat nosed impact pressure probes in arc heated, low density argon flow are reported. The data are compared with those of former experimental and theoretical reports. A physical explanation of the deviations of impact pressure measurements from the inviscid values in flows of rarefied gases is discussed. Author

N69-29463# Commissariat a l'Energie Atomique, Paris (France).
GAMMAGRAPHY WITH LOW-ENERGY PHOTON EMITTERS [LA GAMMAGRAPHIE A L'AIDE D'ENETTEURS DE PHOTONS DE FAIBLE ENERGIE]
J. F. Verant [1968] 12 p refs In FRENCH Presented at the Symp. on Nondestructive Testing and Control in the Field of Nucl. Met. and Technol., Saclay, France, 24 Jun. 1968
(CEA-CONF-1076; CONF-680606-14) Avail: AEC Depository Libraries

The use of ^{170}Tm, ^{128}I, ^{147}Pm, ^{169}Yb, ^{155}Eu, and ^{210}Pb for gammagraphy was studied using Al AS plates. The results showed that ^{170}Tm, ^{169}Yb, and ^{155}Eu gave an image of average quality while ^{128}I gave a good quality image, and ^{147}Pm a very good quality image. The exposure time for ^{170}Tm and ^{169}Yb are good, that for ^{155}Eu is much longer than that of ^{170}Tm. The period of ^{155}Eu is much longer however, which is advantageous. The exposure times for ^{147}Pm and ^{128}I are much longer. NSA

N69-29467# Centre de Physique Electronique et Corpusculaire, Orsay (France).
CONTRAST-ENHANCING AND SIGNAL-INTEGRATING IMAGE-INTENSIFIER STORAGE TUBE. VOLUME 1: THEORETICAL CONSIDERATIONS
Daniel R. Charles and Georg Wendt Wright-Patterson AFB, Ohio AFAL Nov. 1968 162 p refs
(Contract AF 61(052)-723)
(AD-684712; WR-1716-1-Vol-1; AFAL-TR-68-270-Vol-1) Avail: CFSTI CSCL 14/5

The INTIC tube is an electronic analogy of a photographic camera that accepts a visual image and presents it immediately as an electronic image. During the writing phase of the operation, the optical image is transformed into an electronic image which is accelerated and forms a charge pattern on the storage grid. In the readout phase, the storage grid is exposed to a uniform stream of electrons which passes through the holes of the storage grid at a rate determined by the charges around each hole. This forms a second electronic image which is a replica of the optical image and which can be maintained over a selected time period. The electrons forming the second electronic image are highly accelerated. When focussed on a suitable phosphor screen, each electron causes the emission of a number of light quanta, which results in a visible image corresponding to the image on the photocathode. The contrast on the phosphor screen may be enhanced considerably by changing the potential on the storage grid electrode. Employing preamplifying stages permits the fundamental limitation of contrast enhancement to be reached, as determined by statistical fluctuations in the electronic image. Author (TAB)

N69-29468# Centre de Physique Electronique et Corpusculaire, Orsay (France).
CONTRAST-ENHANCING AND SIGNAL-INTEGRATING IMAGE-INTENSIFIER STORAGE TUBE. VOLUME 2: EXPERIMENTAL FINDING
Daniel R. Charles and Georg Wendt Wright-Patterson AFB, Ohio AFAL Nov. 1968 117 p refs
(Contract AF 61(052)-723)
(AD-684713; WR-1716-2-Vol-2; AFAL-TR-68-270-Vol-2) Avail: CFSTI CSCL 14/5

The INTIC tube is an electronic analogy of a photographic camera which provides an instantaneous display of the image, with the possibility of a much improved contrast. The scene is projected onto the photocathode of the tube during exposure. The photoelectrons emitted are focused on the insulating layer which is deposited on a fine mesh and acts as a store; there they produce a corresponding potential pattern. A wide and uniform beam of electrons sprayed through this grid is modulated by the potential pattern and produces the long-life image desired on the screen of the image tube. Tubes with electrostatic or magnetic focusing were produced. The design and production of 12 different types of INTIC tubes and image preamplifiers (52 tubes) are described, as well as the technological progress achieved (choice and deposition of the insulating layer, production of photocathodes of uniform sensitivity on conductive underlayers, electrodes blackening, and sealing of the fiber windows). The test equipment and the results are discussed, in particular the measurements of the storage grid characteristic and comparison of these measurements with the theoretical results, as well as the performance measurements of the INTIC tube type finally adopted. Suggested improvements are given as a conclusion. Author (TAB)

N69-29490*# Volt Information Sciences, Inc., Washington, D.C.
DIFFRACTION THEORY OF SHADOW KNIFE AND SLIT PHOTOMETRIC METHODS
L. A. Vasilyev et al Greenbelt, Md. Goddard Space Flight Center 27 Jun. 1969 6 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR, Ser. Fiz. (Moscow), v. 186, no. 1, 1969 p 70–72
(Contract NAS5-12487)
(NASA-CR-101621; ST-PHM-GO-10850) Avail: CFSTI CSCL 14B

The diffraction theory of shadow knife and slit photometric methods is considered. The basis of measurements conducted by shadow photometric methods lies in the assumption of linear dependence between the deflection angle of the ray and the plane illumination of shadow instrument's image. This dependence follows from the geometrical scheme of the methods. The distribution of the illumination is found in the diffraction pattern, and a dependence is established between the diffraction error and the conditions of measurements. Author

N69-29663*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
A THERMOCOUPLE TECHNIQUE FOR MEASURING HOT-GAS-SIDE WALL TEMPERATURES IN ROCKET ENGINES
Ronald G. Huff Washington Jun. 1969 32 p refs
(NASA-TN-D-5291) Avail: CFSTI CSCL 14B

A technique is given for installing small-size, quartz-insulated, single-wire thermocouples on thin-wall rocket cooling tubes to measure the hot-gas-side wall temperatures. The lead and junction are protected from the hot gases by electroplating metal on the wall, which buries the lead and junction. The plating is faired to the wall to prevent disruption of the boundary layer. The upper temperature limit, which is due to the breakdown of the quartz electrical insulation, is 2060° R (1144°K). Calibrations are given. Author

N69-29616# Arizona Univ., Tucson. Lunar and Planetary Lab.
A 1.5 METER APERTURE PRECISION ON-AXIS LIGHT GATHERER Final Report, 15 Nov. 1966–14 Mar. 1967
Harold L. Johnson, Melvin J. Simmons, Fred F. Forbes, James L. Percy, and Robert L. Waland Nov. 1968 17 p refs
(Contract AF 19(628)-5941)
(AD-685242; AFCRL-68-0659) Avail: CFSTI CSCL 3/1

Research directed toward the design, fabrication, and partial testing of optics for future selenodetic-optical-ranging investigations, has resulted in a 60-inch special-purpose telescope and related housing, now installed at the Lunar and Planetary Laboratory, Catalina Observatory, Site II. The successful use of an aluminum alloy (Tenzalloy) for the optics of this instrument continues to advance the current technology of metal mirrors for special astronomic applications. The improved design of this special-purpose telescope over earlier models still in use at the Observatory, increased its efficiency and ease of operation during tests and observing programs. Author (TAB)

N69-29626# Sandia Corp., Albuquerque, N. Mex.
INTRUSION MONITORING FOR THE UNATTENDED SEISMOLOGICAL OBSERVATORY
P. A. Stokes [1968] 12 p Presented at Conv. on Aerospace and Electron. Systems, Los Angeles Sponsored by AEC
(SC-DC-68-1641; CONF-690202-1) Avail: CFSTI

An observatory was designed for the detection and recording of seismic disturbances related to underground nuclear bursts. Characteristics and a description of all systems are summarized. The protective requirements and philosophy and the protective system criteria are given. An effective Intrusion Detection System can be included as part of Unattended Seismological Observatory (USO) to aid in verifying compliance with a treaty on underground nuclear testing. NSA

N69-29662*# Techtran Corp., Glen Burnie, Md.
ABSOLUTE MEASUREMENT OF RADIANT FLUX
Nobuhi De Ooba Washington NASA Jun. 1969 88 p refs Transl. into ENGLISH of Res. Electrotech. Lab. (Tokyo), no. 675, Dec. 1967 67 p
(Contract NASw-1695)
(NASA-TT-F-12242) Avail: CFSTI CSCL 14B

The establishment of radiometric standards in the spectral region of near UV, visible, and near IR is reported, and as the result, the irradiance (radiant flux per unit area) which is given by an incandescent standard lamp was determined by a group of absolute radiometers. The calibration of radiometers for general use was made possible in absolute scale. There are various types of absolute radiometers which were made by several investigators in the world, but the basic principle of the measurement is the same, that is, they measure the dc electric power that is substituted for the incident radiant flux into the receiver surface. The substitution is performed by adjusting the electric power so that the temperature rise of the receiver plate is the same in both cases of heating, i.e. heating by radiation and by electricity. The receiver plate is a thin silver disk, and a fine platinum wire which is wound spirally and bifilarwise is attached to the disk having thermal contact and electrical insulation. Author

N69-29674 Northwestern Univ., Evanston, Ill.
STUDIES OF METAL COMPLEXES BY ELECTRON-IMPACT MASS SPECTROMETRY
Steven Michael Schildcrout (Ph.D. Thesis) 1968 72 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 69-1935

A positive-ion mass spectrum of $Ni(CO)_4$ was determined using a magnetic-sector instrument capable of distinguishing the molecular beam mass spectrum from possible contributions of pyrolysis intermediates which may form in the ion source. The mass spectrum is in fair agreement with a previous conventional mass spectrum. Evidence for gas-phase intermediates such as $Ni(CO)_3$ could not be found by sampling the contents of a low-pressure flow reactor. The mass spectrum includes metastable-ion peaks, each involving loss of one neutral CO group from a $Ni(CO)_x^{q+}$ ion (q = 1,2), and fragment ions resulting from C–O scission and from rearrangement. From appearance potential data, the ionization potential of $Ni(CO)_4$ is 8.35 ± .15 ev and the mean Ni–C bond dissociation energy in $Ni(CO)_4$ is 39.3 ± 1.0 kcal/mole. Dissert. Abstr.

N69-29716# Centralny Instytut Informacji Naukowo-Technicznej i Ekonomicznej, Warsaw (Poland). Scientific Publications Foreign Cooperation Center.
SOME PROBLEMS CONCERNING THE THEORY OF ERRORS IN COUNTING CIRCUITS (PULSE COUNTERS)
Tadeusz Rzymkowski et al. *In its* Nukleonika, vol. 11, no. 11/12, 1966 1967 p 19–27 refs (See N69-29712 16-24)
Avail: CFSTI

Principal errors occurring in counting systems are defined, and relations and some mathematical derivatives useful in the practical determination of measurement errors are presented. The method developed permits a rational design of counting systems both from the point of view of the quality of the system and the economy of technical solutions. Author

N69-29725*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE MOLECULAR KINETICS OF THE BAYARD-ALPERT AND MODIFIED REDHEAT VACUUM GAUGES USED ON EXPLORER 17 AND EXPLORER 32
James O. Ballance 28 Apr. 1969 65 p refs
(NASA-TM-X-53836) Avail: CFSTI CSCL 14B

A Monte Carlo computer analysis of the internal free-molecular-flow characteristics of the modified Redhead Magnetron and the Bayard–Alpert vacuum gauges used on Explorer 17 and Explorer 32 satellites has been conducted. Although the transmission probabilities for the gauges were determined for a simplified geometric configuration, the results should be valid since a similar approach to the mass spectrometer gauge of the thermosphere probe used on sounding rockets yielded very valid results. The effects of specular reflections from the walls were examined, and a simple time response model of the gauges was determined. Author

N69-29730*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
EVALUATION OF AN INDIRECT VIEWING SYSTEM FOR LIFTING-BODY TERMINAL-AREA NAVIGATION AND LANDING TASKS
Harold G. Gaidsick, William H. Dana, and Robert C. McCracken Washington Jul. 1969 29 p refs
(NASA-TN-D-5299) Avail: CFSTI CSCL 14B

A short-eye-relief optical system, consisting of two monocular periscopes with overlapping fields of view, was mounted in an F-104B airplane to evaluate the feasibility of using an indirect viewing system in place of normal vision for performing simulated lifting-body approaches and landings. Three approach techniques were used in the study. Performance was evaluated by measuring touchdown distance from a marked touchdown point and rate of sink and airspeed at touchdown. Results obtained with the optics system were compared with normal vision results. The ability of the pilots to perform simulated lifting-body tasks was not noticeably reduced with the optics system. The workload and other pilot acceptance factors, however, indicated that this particular system required improvement in design, even though the pilots could readily adapt to its use. Although the results of this flight evaluation are acceptable in terms of optics system evaluation, it was apparent that more effort is required in the development of local-area navigational techniques, specifically to include limited visibility conditions. Author

N69-29742# New York Univ., N. Y. Aerospace Lab.
THE DESIGN AND OPERATION OF A HIGH MACH NUMBER–REYNOLDS NUMBER FACILITY
Victor Zakkay Dec. 1968 52 p refs
(Contract AF 33(615)-3236)
(AD-684705; ARL-68-0213) Avail: CFSTI CSCL 14/2

A facility capable of operating at Mach number 10, and a Reynolds number of 2x10 to the 7th power/ft was designed, built and calibrated. The facility is capable of operating at stagnation pressures up to 30,000 p.s.i., and a stagnation temperature of 1800R. A running time of three seconds is available with the present design; however, an increase in the running time may be obtained by increasing the air storage system. A method for increasing the stagnation temperature capability of the facility to 3500R is also outlined within the main body of the report. Author (TAB)

N69-29756# Dayton Univ. Research Inst., Ohio.
AFML ELECTRICAL PLATE SLAP FACILITY
D. D. Preonas Nov. 1968 60 p refs
(Contract F33615-68-C-1138)
(AD-685189; UDRI-TR-68-43; AFML-TR-68-352) Avail: CFSTI CSCL 14/2

A facility to produce one-dimensional impacts was constructed. The high pressures developed by an exploding foil are used to launch relatively thin flat plates. The energy to explode the foil is

provided by a fast discharge 100 kilovolt capacitor bank. Two types of exploding foil assemblies were developed to launch primarily 3.81 cm x 3.81 cm x 0.127 mm Mylar plates at velocities of from 0.1 to 3.5 km/sec. Ultrahigh speed framing camera photographs are taken of every test to determine the planarity and velocity of the launched plate. Other streak or framing cameras are available so that a variety of optical measurements can be made for each test. Author (TAB)

N69-29763# Office of Aerospace Research, Arlington, Va.
INTRODUCTION TO HOLOGRAPHY
Melvin C. Watkins Dec. 1968 10 p refs *Its* Monograph No. 5
(AD-685400; OAR-68-0015) Avail: CFSTI CSCL 14/5

This monograph seeks to provide a descriptive definition of a term, Holography, which is one of the latest contributions of science to the ever-growing technical vocabulary. Holography, as such, reflects a process whereby the amplitude and phase information contained within the image of an illuminated object can be photographically recorded, stored and retrieved. The recording, itself, is called a hologram. To further an understanding of the holographic process, the author discusses basic concepts, and describes a few of its most attractive applications. Author (TAB)

N69-29769# Comstock and Wescott, Inc., Cambridge, Mass.
INSTRUMENTATION FOR STUDIES OF SOLAR EXTREME ULTRAVIOLET RADIATION Final Report, 1 Jul. 1965–30 Jun. 1968
Pieter R. Wiederhold and John F. McGrath, Jr. 29 Nov. 1968 183 p refs
(Contract AF 19(628)-5168)
(AD-685199; AFCRL-69-0004) Avail: CFSTI CSCL 3/2

The report describes the design, development, construction, field servicing and flight of EUV monochromators employed in rocket experiments to obtain intensity measurements of solar radiation in the extreme ultraviolet and soft X-ray regions of the spectrum. It also describes the mechanical design, development, construction and use of the laboratory facilities used in the calibration of these rocket monochromators. Author (TAB)

N69-29822# European Atomic Energy Community, Ispra (Italy).
INSTRUMENTATION FOR RAPID MECHANICAL TRANSIENTS IN MODEL SCALE EXPERIMENTS
P. Actis Dato, H. Holtbecker, E. Jorzik, Y. Lachapelle, A. Masserati et al *In its* Shock Struct. Interactions in Reactor Vessels Oct. 1968 p 153–192 refs (See N69-29815 16-22)
Avail: CFSTI

The gages required for a model study of structural response to dynamic loading conditions caused by an explosion are described. A pressure transducer is necessary for determining the time of the load acting on the structure, while a strain gage is needed to measure strain versus time. After examining the types of instruments available for the dynamic, high precision pressure measurements, bar transducers with either piezoelectric or strain gage sensitive elements were chosen. The design, operating characteristics, and performance of each type of transducer is discussed, followed by a summary of their characteristics based on sensitivity, temperature and irradiation limits, rise time, and accuracy. A brief evaluation of the behavior and problems involved in the use of strain gages in dynamic measurements is presented in conclusion. A.C.R.

N69-29835# Army Foreign Science and Technology Center, Washington, D.C.
THE NEW HIGH PRECISION OPTICAL THEODOLITE, T1
D. A. Anikst [1968] 15 p ref Transl. into ENGLISH from Geodez. i Kartograf. (Moscow), no. 6, Jun. 1968 p 24–29
(AD-685669; FSTC-HT-23-667-68) Avail: CFSTI CSCL 17/8

This article describes the new Soviet T1 theodolite, which was developed by EOMZ, TsNIIGAiK (Electrotechnical, Optical and Mechanical Plant, Central Scientific Research Institute of Geodesy, Aerial Survey, and Cartography). Its production is to begin in 1969. The T1 is designed to replace the OT-02 model theodolite. It incorporates several unique features in its design to make it a very high-precision instrument to be used in machine building, architectural construction, and various engineering enterprises. The T1 can be used in all four orders of triangulation and polygonometry. Author (TAB)

N69-29844# National Bureau of Standards, Washington, D.C. Inst. for Applied Technology.
CONSIDERATIONS IN COMPUTING THE USEFUL FREQUENCY RANGE OF PIEZOELECTRIC ACCELEROMETERS
Nathan Newman Jul. 1969 19 p
(NBS-TN-487) Avail: SOD $0.30

Two lumped-parameter models for computing the usable frequency range of piezoelectric accelerometers are analyzed. The analyses indicate why application of an electrical excitation to the piezoelectric element of a mounted pickup does not, in general, give the same result as application of a mechanical acceleration to the structure on which the pickup is mounted. Tabular results of the computations for various sets of parameters indicate those cases for which the electrical drive will give resonant frequency values within 2% of those for the pickup mounted on a vibrating structure. For these parameter sets, the electrical drive can be used as a reliable substitute. E.N.

N69-29851# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RECORDING SHOCK WAVES AND EXPLODING WIRE ELECTRICAL CHARACTERISTICS
Yu. A. Kotov et al 12 Jul. 1968 15 p refs Transl. into ENGLISH from Elektronnaya Obrabotka Materialov (USSR), no. 3, 1968 p 28–32
(AD-685489; FTD-MT-24-184-68) Avail: CFSTI CSCI 14/2

A system for the recording of shock-wave velocities and the current and voltage in an exploding wire is described. The purpose of the present work is to create a source of shock waves with controllable (variable) parameters. The solution of the problem consists in the strict synchronization of the basic elements of the system. The circuitry and its operation are described and its components discussed. Author (TAB)

N69-29879*# General Electric Co., Binghamton, N.Y. Avionics Controls Dept.
TWIN CMG SYSTEMS Final Report
C. F. Auclair and N. S. Chester Apr. 1969 90 p refs
(Contract NAS9-8181)
(NASA-CR-101728; ACD-9503) Avail: CFSTI CSCL 14B

Work was directed toward providing a control moment gyro (CMG) system that is compatible with the NASA/MSC air-bearing space vehicle motion simulator. Three twin control moment gyroscope systems have been developed, fabricated, and tested. The hardware includes six single-degree-of-freedom control moment gyroscopes mounted in three twin pairs, three electronic

packages, and three mounting fixtures for alignment. The analyses, reports, drawings, and manuals necessary for their description, operation, and maintenance are presented. Main characteristics of each twin CMG system are: momentum storage (adjustable), 10-40 ft-lb-sec; and maximum output torque, 150 ft-lb. The three twin CMG systems were tested and evaluated; they were found to meet or exceed all of the specifications. Author

N69-29897# Massachusetts Inst. of Tech., Cambridge. Experimental Astronomy Lab.

INVESTIGATION OF VISIBLE REGION INSTRUMENTATION FOR OCEANOGRAPHIC SATELLITES. VOLUME 2

A. C. Conrad, A. Boersma, and M. G. Kelly Mar. 1968 63 p refs

(Contract N62306-2082)

(AD-684145; RE-31-Vol-2) Avail: CFSTI CSCL 20/6

A review of the present state of the art in visible region passive instruments for over-water surveying is reported. Experiments are described in which some possible techniques of data collection were tested. The areas in which further work is needed are described, and the suggested studies and experiments are outlined. Author (TAB)

N69-29937# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PHOTO-OBSERVATION DEVICE OF GREAT MAGNIFICATION

I. A. Teltevskii and I. A. Chernyi Jul. 1968 12 p refs Transl. into ENGLISH from Zh. Nauch. i Priklad. Fot. i Kinematogrfii (Moscow), v. 12, no. 4, 1967 p 274-279

(AD-684990; FTD-HT-23-341-68) Avail: CFSTI CSCL 14/5

A camera equipped with a two-lens system of long focal length (600 and 3000 mm respectively) and with a telescopic view finder is described. A schematic of the optical system and pictures of the camera are presented. It was found that the new camera is capable of taking photographs with a resolution of 2 in. and with edge distortion of less than 0.03%. A comparison of photographs taken with an ordinary camera of f = 50 mm and of those taken with the new camera is presented. The latter pictures showed a degree of detail 12 to 60 times greater than those taken with the ordinary camera. Author (TAB)

N69-30000# Fluggeraetewerk Bodensee, G.m.b.H., Ueberlingen (West Germany).

DEVELOPMENT OF AN ALL-ELECTRONIC STAR SENSOR WITH IMAGE DISSECTOR TUBE [ENTWICKLUNG EINES VOLLELEKTRONISCHEN STERNSENSORS MIT IMAGE-DISSECTOR-ROEHRE]

W. Bross Nov. 1968 31 p refs

In GERMAN; ENGLISH summary Sponsored by Bundesmin. für Wiss. Forsch.

(BMwF-FB-W-68-76) Avail: CFSTI

Departing from the principles of the scanning method, the design of a star sensor is described which automatically transfers from search to lock-on mode, where the scan rate is very high so that noise in the star position data is low. This system precludes drift errors. An experimental star sensor was built, which has excellent on-axis accuracy, the off-axis accuracy being limited only by the imperfections of the electron lens and the deflection yoke. Author (ESRO)

N69-30018# Landessternwarte auf dem Koenigstuhl, Heidelberg (West Germany).

CALIBRATION OF RADIATION SOURCES IN THE VACUUM ULTRAVIOLET BY COMPARISON WITH THE SYNCHROTRON RADIATION OF THE DEUTSCHES-ELECTRONEN-SYNCHROTRON (DESY) [KALIBRIERUNG VON STRAHLUNGSQUELLEN IM VAKUUM-ULTRAVIOLETT DURCH ANSCHLUSS AN DIE SYNCHROTONSTRAHLUNG DES DEUTSCHEN-ELEKTRONEN-SYNCHROTRONS (DESY)]

W. Boehm, D. Labs, D. Lemke, and E. Pitz Jan. 1969 106 p refs In GERMAN; ENGLISH summary Sponsored by Bundesmin. für Wiss. Forsch.

(BMwF-FBW-69-09) Avail: CFSTI

The applicability of the synchrotron radiation of the Deutsches-Elektronen-Synchroton (DESY) as a fundamental radiometric standard in the ultraviolet region of the spectrum was investigated. By means of the synchrotron radiation spectrographs or light sources – especially for astrophysical experiments – can be calibrated with an accuracy of 4 % in the vacuum-ultraviolet. In the spectral range from 1650 Å to 2700 Å gas discharge lamps have been calibrated with this accuracy. Furthermore the transition radiation as a possible secondary standard light source is discussed. Author (ESRO)

N69-30021# Imperial Coll. of Science and Technology, London (England).

A LOW-ENERGY ALPHA PARTICLE AND PROTON TELESCOPE

F. Hille Paris ESRO Apr. 1968 48 p refs Sponsored by ESRO

(ESRO-SN-91) Avail: CFSTI

A detector telescope for low-energy alpha particles and protons has been built using silicon surface barrier detectors. The intention was to investigate the suitability of such a system for the measurement of small fluxes of alpha particles in the presence of large fluxes of energetic protons. Interactions of high-energy protons with the silicon nuclei in the detectors have been found to produce background signals simulating the detection of alpha particles. This effect limits the application of silicon detectors to composition measurements in the sense that a silicon detector by measuring dE/dx cannot reliably detect small fluxes of heavy particles in the presence of large fluxes of energetic protons. Author (ESRO)

N69-30126# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.

CONTRIBUTION TO THE STUDY AND DEVELOPMENT OF CONTINUOUS INFRARED ABSORPTION ANALYZERS [CONTRIBUTION A L'ETUDE ET A LA MISE AU POINT DES ANALYSEURS EN CONTINU PAR ABSORPTION INFRAROUGE]

André Coste (Ph.D. Thesis–Paris Univ., 21 Dec. 1967) Jan. 1969 106 p refs In GERMAN; ENGLISH summary

(CEA-R-3527) Avail: CFSTI

The continuous infrared absorption determination of corrosive gases requires the construction of an original single-beam spectrometer. The use of a vibration-rotation line means that the apparatus function has to undergo an alternating displacement : for one position this function is centered on the line, and for another position it is placed close by it but away from any absorption. A nonlinear relationship is derived between the concentration of the impurity under consideration, the optical density measured at the center of the line and the total pressure of the gas mixture. The problem is then solved using an associated specific analog computer. The system is applicable to the determination of low concentrations. The principle proposed is then adapted to an analysis using a non-resolved vibration-rotation band. Author (ESRO)

N69-30177*# Techtran Corp., Glen Burnie, Md.
A FOUR AXIS TELESCOPE MOUNTING FOR PHOTOELECTRIC PHOTOMETRY OF ARTIFICIAL EARTH SATELLITES [CZTEROOSIOWY MONTAZ TELESKOPU DO FOTOELEKTRYCZNEJ FOTOMETRII SZTUCZNYCH SATELITOW ZIEMI]
B. Kolaczek Washington NASA Jun. 1969 7 p refs Transl. into ENGLISH from Postepy Astronomiy (Poland), v. 16, Jan. – Mar. 1968 p 72–76
(Contract NASw-1695)
(NASA-TT-F-12292) Avail: CFSTI CSCL 14E

Details are given on a four-axis mounting for a telescope designed to provide improved approximation of the satellite topocentric trajectory in photoelectric photometry observations. The four-axis mounting makes it possible to fix the pole of the satellite orbit in a plane passing through the zenith and the point of maximum satellite altitude, and to correct the telescope motion along the great circle by introducing additional rotation about a fourth axis. Graphs are given which compare the corrections to the approximated satellite trajectory when using two-, three-, and four-axis mountings. Author

N69-30279# Los Alamos Scientific Lab., N. Mex.
THE 1965 ARPA-AEC JOINT LIGHTNING STUDY AT LOS ALAMOS. VOLUME 4: DISCRIMINATION AGAINST FALSE TRIGGERING OF AIR-FLUORESCENCE DETECTION SYSTEMS BY LIGHTNING
Guy E. Barasch 3 Apr. 1969 29 p refs
(Contract W-7405-eng-36; ARPA Order-631)
(AD-685442; LA-3757-Vol-4) Avail: CFSTI CSCL 18/4

Optical discrimination techniques to prevent false triggering of nuclear-explosion-excited air-fluorescence detection systems by lightning are evaluated. The spectra of lightning and of air fluorescence are very different: lightning emits a strong continuum and neutral and ionized atomic line radiations, whereas the air-fluorescence spectrum is primarily molecular band radiation. The discrimination technique makes optimum use of two detectors to identify the source of a light pulse through these differences. False triggering of the detection system occurs either when the source is misidentified or when one of the measurements cannot be made because the incident signal at that wavelength is below the detection threshold. The present evaluation is a statistical prediction of false-triggering rates taking into account: lightning emissions, air-fluorescence emissions, atmospheric propagation mechanisms, detector-component parameters, and background radiation. Author (TAB)

N69-30280# Ballistic Research Labs., Aberdeen Proving Ground, Md.
AN APPLICATION OF PATTERN RECOGNITION TO RADIOMETRIC TARGET DETECTION
William G. Lese, Jr., Richard A. McGee, and William J. Sacco Feb. 1969 31 p refs
(AD-684904; BRL-MR-1962) Avail: CFSTI CSCL 17/5

Classical detection theory is used to provide a framework for the study of the potential of passive detection of metallic targets by millimeter wave radiometry. The target is assumed to be embedded in a foliage environment. The problem is characterized as a two-class detection problem. Class C sub 1 denotes the class of measurements obtained when the field of view V of the radiometer contains some target elements, and C sub 2 represents the class of measurements obtained when V contains no target elements. Each of the measurement sets is characterized by probability density functions. These functions are used to obtain operating characteristic curves relating alpha and beta errors and to determine discriminant functions for the detection problem. The alpha error is the probability of assigning an observation to class C sub 1 when it belongs to C sub 2, and the beta error is the probability of assigning an observation to class C sub 1 when it belongs to C sub 2. Operating characteristic curves are useful in determining the amount of target obscuration for various alpha and beta errors. Author (TAB)

N69-30344# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
MODEL 2 IMAGE DISSECTOR CAMERA SYSTEM
John R. Dozsa Nov. 1968 74 p refs
(Contract NOw-62-0604-c)
(AD-684795; APL-TG-1019) Avail: CFSTI CSCL 17/2

Line scan television cameras offer significant advantages over snapshot cameras for geographically continuous earth observation from an orbiting satellite. A study program has developed a laboratory model of a line scan camera utilizing an image dissector sensor and folded fiber optics for scene rectification. The cameras electronic circuitry design and performance are described in this report. Author (TAB)

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N69-29062# Sandia Corp., Albuquerque, N. Mex. Process Applications Div.
ROLAMITE FOUR-PIECE CASE FABRICATION STATUS REPORT
E. S. Roth Feb. 1969 17 p Sponsored By AEC
(SC-DR-69-12) Avail: CFSTI

The status of the processes developed to manufacture, inspect, selectively assemble, join, and then final inspect four-piece rolamite pumper cases is described. Enough piece parts have been manufactured and preinspected to assemble 50 cases within a size range of 0.0005 inch and to tolerances of from ±0.000050 inch to ±0.0002 inch. Nine of these cases have been assembled and some are being used as mandrel molds. Since the design of the pumper case has changed since this development was started, the remaining cases may never be assembled. Author (NSA)

N69-29087# Bureau of Mines, Washington, D.C.
COMPUTER USAGE FOR EVALUATION OF DESIGN PARAMETERS AND COST OF HEAT EXCHANGERS WITH NO CHANGE IN PHASE AND TUBE SIDE PUMPING COSTS AS PRIME PARAMETERS
P. R. Jones and S. Katell Jan. 1969 72 p refs
(PB-182871; IC-8399) Avail: CFSTI CSCL 13A

A computer program was written for design and cost of a shell and tube heat exchanger in which the total cost, which includes annual fixed charges and annual operating costs, was minimized. The program was written for the type of heat exchanger in which only the tube side pumping costs were significant and for triangular pitch, single or multiple pass, heating or cooling, and no change in phase. Tube diameter was not optimized since the tube dimensions do not affect the cost very much. However, the tube dimensions do affect the shell diameter, number of tubes and length of tubes; and price optimum design was obtained for four

standard tube diameters. Standard heat exchangers having at least the required area are also listed. The program was made adaptable to various fluids and to various tube dimensions by including many of the required data such as physical properties of the fluids, tube data, and standard shell data as input data. Author (USGRDR)

N69-29165*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHOD FOR PREDICTION OF PUMP CAVITATION PERFORMANCE FOR VARIOUS LIQUIDS, LIQUID TEMPERATURES, AND ROTATIVE SPEEDS
Robert S. Ruggeri and Royce D. Moore Washington Jun. 1969 33 p refs
(NASA-TN-D-5292) Avail: CFSTI CSCL 13K

A method for predicting the cavitation performance of pumps with various liquids, liquid temperatures, and rotative speeds is presented. Both theoretical and experimental studies used in formulating the method are discussed. Good agreement was obtained in comparisons between experimental and predicted results of cavitation performance for several pumps operated in liquids that exhibit a wide range of physical properties. Use of the method requires that two sets of test data be available for the pump and operating conditions of interest, but these data need not be for the same liquid, temperature, or pump speed. Numerical examples are presented. Author

N69-29267# Technische Hochschule Hannover (West Germany). Fakultaet fuer Maschinenwesen.
CALCULATION OF OPTIMUM TOOLS FOR ELECTROMAGNETIC FORMING [ZUR BERECHNUNG VON OPTIMALEN WERKZEUGEN FUER DAS ELEKTROMAGNETISCHE UMFORMEN]
Wilfried Dicke (Ph.D. Thesis) 1968 131 p refs In GERMAN
Avail: CFSTI

A method is presented for calculating the maximum pressure, the discharge frequency, and the optimal time curve of the pressure during high-speed magnetic forming of tubular work pieces. The method takes into account the electrical parameters of the pulse current generator, the differing magnetic induction processes in the work piece and the coil, and the inductive fluctuation in the magnetic energy. It was experimentally determined that the impulse imparted to the work piece, not the maximum pressure, is decisive for obtaining a maximum diameter change. Based on coil calculations, a new type of coil was developed which has a greater number of ampere/windings per length and a smaller ohmic loss as well as improved mechanical strength. It is shown that the crowbar technique can be mathematically investigated for its usefulness in magnetic forming. Transl. by K.W.

N69-29283# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EFFECT OF AXIAL LOADING ON THE MAGNITUDE OF VIBRATION GENERATED BY BALL BEARINGS
I. V. Baranov 8 Nov. 1968 10 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad), v. 10, no. 12, 1967 p 63–65
(AD-684048; FTD-HT-23-1011-68) Avail: CFSTI CSCL 13/9

The effect of axial loading on the vibration of a radial ball bearing was investigated. The radial gap and the waviness of the path of the free play of the rings are considered to be the main sources of vibration. The radial clearance produces vibrations of the inner ring of ball bearings in the direction of the y-axis which decrease with increasing axial loads; the path vibration of the ball moving along the x-axis on a wavy surface increases with increasing axial loads. The resulting vibration of the ball bearing first decreases to a minimum, then increases to a maximum and remains constant. The character of these vibrations was proven on six types of ball bearings at 12,000 rpm. The vibration spectrum of one of these bearings at axial loads of 0.2 and 2.5 kg shows a prevalence of low frequency vibrations at small loads and high frequency vibrations at high loads. Author (TAB)

N69-29306*# General Electric Co., Schenectady, N.Y. Specialty Fluidics Operation.
FLUIDIC PROPORTIONAL THRUSTER SYSTEM Final Report
T. S. Honda, W. L. Keltz, and R. K. Rose May 1969 126 p
(Contract NAS2-4490)
(NASA-CR-73304; S-69-1079) Avail: CFSTI CSCL 13K

A proportional thrust control concept, based on the use of a pair of vortex valves, is described. A description of the three axis thruster control package developed for a solar pointing Aerobee rocket control system is also presented. The report contains the results of hardware evaluation with analog simulation of the vehicle and on an air bearing simulator. The vortex valve development and attitude control system study and synthesis included in the program work are discussed. Author

N69-29367 Illinois Univ., Urbana.
DOUBLE ROTOR INDUCTION MOTOR
Donald Harry Kelly (Ph.D. Thesis) 1968 110 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-1370

The double rotor machine differs from a drag cup machine in that the rotor is closed at both ends so that the core must be pivoted inside the rotor. Since it is possible for currents to flow in the core as well as the rotor, torque may be developed in the core and the core may rotate at a speed differing from the rotor. Interaction between core and rotor can then occur, modifying the rotor characteristics. Maxwell's equations may be used to determine the fields present in the machine and equivalent circuits developed from these, on the basis of quasistatic conditions. A circuit model is developed, including the effects of spatial harmonics in the field distribution. Analysis of this model then shows the effects of core conductivity and core speed on the rotor speed-torque characteristics. The general effect is a reduction of developed torque at all rotor speeds except for core speeds near and above synchronous speed. Dissert. Abstr.

N69-29471# Mechanical Technology, Inc., Latham, N. Y.
FEASIBILITY OF GAS BEARINGS FOR SMALL HIGH-PERFORMANCE AIRCRAFT GAS TURBINES Final Technical Report
Peter William Curwen Mar. 1969 334 p refs
(Contract DAAJ02-67-C-0036)
(AD-684956; USAAVLABS-TR-68-87) Avail: CFSTI CSCL 13/9

The object of this contractual effort was to determine the feasibility of incorporating gas bearings in a small high-performance aircraft gas turbine engine. This report describes a gas generator designed to incorporate gas bearings and the studies undertaken in the bearing design process. Discussion is presented in areas of selection of bearing type, design of journal and thrust bearings, accommodation of bearing loads, thermal studies and bearing materials. Author (TAB)

N69-29478*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INVESTIGATION OF TWO-PHASE HYDROGEN FLOW IN PUMP INLET LINE
Donald C. Urasek, Phillip R. Meng, and Robert E. Connelly Washington Jul. 1969 17 p refs
(NASA-TN-D-5258) Avail: CFSTI CSCL 13K

An investigation was conducted to evaluate the vapor to mixture volume ratio present in the inlet line of a pump when

liquid hydrogen is pumped in a boiling condition from a sealed tank. Both an experimental and an analytical approach were used. The good agreement obtained between the experimental and analytical results indicated that the vapor- to mixture-volume ratio can be predicted with reasonable accuracy. These estimated values of vapor- to mixture-volume ratio, when used with previously reported results, may be useful in predicting pump inducer performance with two-phase flow. Author

N69-29854# National Engineering Lab., Glasgow (Scotland). High Temperature Materials and Metallurgy Div.

BALL BEARING STEELS: FACTORS INFLUENCING ROLLING CONTACT FATIGUE RESISTANCE

D. Scott Aug. 1968 23 p refs Presented at ISI/BISRA Joint Conf. on Low Alloy Steels, Scarborough, Eng., 2-4 Apr. 1968
(NEL-360) Copyright. Avail: CFSTI

Relevant work on the factors affecting the rolling contact fatigue resistance of ball-bearing steels are briefly reviewed. The useful life of rolling elements is limited by surface disintegration, pits being formed by a fatigue process dependant upon the properties of the material, the nature of the lubricant, and the environment. The phenomenon is influenced by highly localized conditions as well as by the general properties of the bulk material. The steelmaking process can influence rolling fatigue life; vacuum techniques are beneficial. There is an optimum hardness for En31 steel. Fiber orientations in relation to bearing surface and surface finish can influence fatigue life. Material combination is important. The nature of the lubricant and the environment can have a dominant effect. High speed tool steels are not so prone to deleterious lubricant effects as En31 steel. Author

N69-29568*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

RARE EARTH FLUORIDES AND OXIDES: AN EXPLORATORY STUDY OF THEIR USE AS SOLID LUBRICANTS AT TEMPERATURES TO 1800 DEG F (1000 DEG C)

Harold E. Sliney Washington Jul. 1969 25 p refs
(NASA-TN-D-5301) Avail: CFSTI CSCL 11H

Powdered lanthanide trifluorides such as LaF_3 and CeF_3, used as solid lubricants, significantly reduced the wear of Inconel 600 riders in sliding contact with Inconel 750 during lubrication experiments in air and in argon at temperatures up to 1800°F (1000°C). Rare earth oxides were poor lubricants compared to the fluorides. Fluoride powders were good film-formers; they were smeared into adherent film on the wear track by the stresses in the zone of sliding contact. The oxides were not film-formers. It was also shown that fusion-bonded LaF_3 and CeF_3 coatings, containing CaF_2-BaF_2 eutectic or LiF as melting point depressants, have possibilities as solid lubricant coatings. Author

N69-29708*# Midwest Research Inst., Kansas City, Mo.

DEVELOPMENT OF LUBRICATING OILS SUITABLE FOR USE WITH LIQUID OXIDIZERS Final Summary Report, 4 Mar. 1968-4 Mar. 1969

L. W. Bread, J. C. Wiley, Jr., and R. L. Elliott 4 Mar. 1969 63 p refs
(Contract NAS8-21269)
(NASA-CR-98480) Avail: CFSTI CSCL 11H

A series of polyfluoroalcohol derivatives, including esters, ethers, phosphates, phosphonates, cyanurates, and phosphonitrilates, was prepared and each of the materials was screened for its stability against impact in the presence of liquid oxygen. Fluid range data, including atmospheric pressure boiling points and pour points, were determined. Details of the experimental work are summarized in which attempts were made to modify the originally prepared structures and improve the liquid range without decreasing the liquid oxygen stability. In addition to determining the fluid properties of some of the esters, including viscosity, volatility, corrosiveness, and hydrolytic stability, a fluorocarbon telomer-thickened polyfluoroalkyl ester grease was prepared and consistency, oil separation, dropping point, and aluminum shear sensitivity were determined. Author

N69-29865# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CERTAIN METHODS OF THE GAS-DYNAMICS THEORY OF LUBRICATION

L. G. Stepanyants 11 Oct. 1968 31 p refs Transl. into ENGLISH from Tr. Leningr. Politekhn. Inst. (Moscow), no. 280, 1967 p. 27-43
(AD-685528; FTD-MT-24-276-68) Avail: CFSTI CSCL 20/4

Some results of the gas-dynamic theory of lubrication and methods for calculating gas-lubricated bearings are presented. The principal equations of nonisothermal lubrication are given. Author (TAB)

N69-29929# Technische Hochschule Hannover (West Germany). Fakultaet fuer Maschinenwesen.

SCRATCH AND WEAR STUDIES ON HARD-BRITTLE MATERIALS USING SINGLE-GRIT CUTTING TOOLS [RITZ- UND VERSCHLEISSUNTERSUCHUNGEN AN SPROEDEN WERKSTOFFEN MIT EINZELKORNBESTUECKTEN HARTSTOFFWERKZEUGEN]

Dieter Martin Busch (Ph.D. Thesis) 1968 122 p refs
Avail: CFSTI

Scratch hardness studies on glass and metal surfaces with conical polished diamond tools show that a fine fracture line propagates ahead of the cutting tool. Increased chip widths and chip pressures increase correspondingly specific crack energies and result in plastic deformations of brittle and hard materials with clod-like structural deformations along scratch line edges. Best results are obtained with pointed abrasive diamond grains oriented axisymmetrically parallel to the scratch direction. Transl. by G.G.

N69-30002 Labratorio de Acustica e Sonica, San Paulo (Brazil).

ULTRASONIC INSPECTION OF FORGED STEEL BLOCKS ACCORDING 'ASTM:A-388' [INSPECAO ULTRA-SONICA DE BLOCOS DE ACO FORJADO DE ACORDO COM 'ASTM:A-388']

L. X. Nepomuceno et al 21 Nov. 1968 14 p refs In PORTUGUESE; ENGLISH summary
(TN-6811.349) Avail: CFSTI

The procedure, standards, and specifications followed are described, as well as the equipment used in the ultrasonic inspection of forged steel blocks for flaw detection before machining. The results are presented in the form of schematic drawings showing the flaw location, as well as the corresponding echograms. Author

N69-30062*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A FABRICATION PROCESS FOR GLASS COATED ELECTRON-BOMBARDMENT ION THRUSTER GRIDS

Bruce A. Banks Washington Jul. 1969 40 p refs
(NASA-TN-D-5320) Avail: CFSTI CSCL 13H

A method was developed for producing nearly bubble-free glass coatings for molybdenum ion thruster accelerator grids. The method involves a helium diffusion process. Grids for 5-, 15-, and 30-cm-diameter thrusters were fabricated and tested. Pertinent grid design criteria and test results are presented. Author

N69-30089*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EFFECT OF FLUID TEMPERATURE ON THE CAVITATION PERFORMANCE OF A HIGH HUB-TIP RATIO AXIAL FLOW PUMP IN WATER TO 250 DEGREES F (394 K)
Walter S. Cunnan, George Kovich, and Dean C. Reemsnyder Washington Jul. 1969 32 p refs
(NASA-TN-D-5318) Avail: CFSTI CSCL 13K

An axial flow pump was tested in deaerated water at temperatures to 250°F. Noncavitation performance is independent of fluid temperature in this range. A reduction in the required net positive suction head of 2.0 to 6.0 feet was measured in 250°F water under that in 80°F water at similar operating conditions. This improvement in cavitation performance increases with increasing flow coefficient and decreasing head-rise coefficient ratios. Cavitation formations in the rotor were visually observed and photographed in 80°F water. Slight suction surface cavitation damage occurred near the tip leading edges during the 162 hours of operation. Author

N69-30086 Laboratorio de Acustica e Sonica, San Paulo (Brazil).
ACCELERATION AND SOUND LEVELS WITH OCTAVE BAND SPECTRAL ANALYSIS OF THE VIBRATION AND NOISE DUE TO AN AIR COMPRESSOR SET [MEDIDAS EM NIVEIS GLOBAIS E ANALISE ESPECTRAL EM FAIXAS DE OITAVAS DAS VIBRACOES E BARULHO PRODUZIDO POR CONJUNTO DE COMPRESSORES]
L. X. Nepomuceno, V. Brecheret, and F. Lucchesi 13 Jan. 1969 23 p refs In PORTUGUESE; English summary
(TN-6901.361) Avail: CFSTI

The report describes the localization and machinery for the production of compressed air with the vibration and sound analysis, the adopted specifications, and procedures for the measurements. The results are presented in tabular form with graphic octave spectrum in the central frequencies indicated by ISO/ONU. There is a convenient resilient-resistive fixation in order to prevent the transmission of the vibration to the adjacent factory areas, with the corresponding results in the sound level. Author

N69-30142*# Waterloo Univ. (Ontario). Manufacturing Sciences Lab.
ON THE ACCURACY OF A THEORY OF HYDRODYNAMIC LUBRICATION IN COLD STRIP ROLLING
D. S. Bedi and M. J. Hillier Aug. 1968 23 p refs
(RR-12) Avail: CFSTI

The theory of cold rolling with full fluid film lubrication is extended to cover a range of possible fluid film thickness distributions, the pressure coefficient of viscosity, and the effect of pressure gradient on lubricant shear stress. A best estimate of the actual film thickness distribution is made using a least energy principle. The effect of a range of possible simplifying assumptions on the accuracy of pressure distribution, roll load, and roll torques is examined. It is found that the most appropriate lubricant film thickness distribution is of exponential type and that only roll torques are sensitive to simplifying assumptions: Pressures and roll loads may be estimated very closely by a simplified theory. Author

N69-30161 Laboratorio de Acustica e Sonica, San Paulo (Brazil).
ULTRASONIC INSPECTION OF LARGE SIZE METALLIC BEARINGS FOR EVALUATION OF BONDING [INSPECAO ULTRA-SONICA DE MANCAL DE ENCOSTO DE GERADOR ELETRICO PARA VERIFICACAO DA ADERENCIA]
L. X. Nepomuceno and H. Onusic 10 Jan. 1969 6 p refs In PORTUGUESE; ENGLISH summary
(TN-6901.362) Avail: CFSTI

The inspection of parts, the adopted procedures, standards, and specifications followed for the ultrasonic inspection of electric generator bearings for the evaluation of bonding are described. The results are presented in schematic drawing form, with indication of the defective zones. Author

N69-30211*# Coast Guard, Baltimore, Md. Field Testing and Development Center.
TESTS OF 500 WATT TUNGSTEN HALOGEN LAMP
G. P. Clark Apr. 1969 36 p ref
(AD-684870; Rept-493) Avail: CFSTI CSCL 13/1

The report discusses a double-ended Quartz-Tube 500-Watt Tungsten-Halogen lamp with a luminous efficacy of 16.4 lumens per watt. Laboratory tests were conducted on prototype lamps of this line. These tests include horizontal polar intensity and vertical divergence of these lamps in eleven lenses, lanterns, and beacons, as well as filament dimensions, luminous output, and incandescence profile. Author (TAB)

N69-30225*# Electrotechnical Lab., Tokyo (Japan).
STUDY ON EXTERNALLY PRESSURIZED AIR BEARINGS
Shinichi Togo Oct. 1968 115 p refs In JAPANESE; ENGLISH summary
(Rept-689) Avail: CFSTI

This study investigates the characteristics of externally pressurized air bearings and obtains basic knowledge on how to design them. This analysis consisted of five major items: (1) analysis of pocket pressure and load carrying capacity of externally pressurized air journal bearings; (2) determination of the pressure distribution and load carrying capacity by means of electric conducting sheet analogy; (3) measurement of frictional moment; (4) experimental observation of stability phenomenon; and (5) high speed grinding test using an air bearing designed according to information derived from this study. Author

N69-30280*# Naval Civil Engineering Lab., Port Hueneme, Calif.
LIGHT HOUSINGS FOR DEEP-SUBMERGENCE APPLICATIONS. PART 3. GLASS PIPES WITH CONICAL FLANGED ENDS Final Report, Nov. 1966–Jun. 1968
K. O. Gray and J. D. Stachiw Mar. 1969 55 p refs
(AD-685837; NCEL-TR-618) Avail: CFSTI CSCL 13/1

The objective of this study was to evaluate commercially available glass pipes with conical flanged ends for application as transparent housings for underwater lights and instruments. Flanged-end glass pipes in diameters ranging from 1 inch to 6 inches and in lengths ranging from 6 inches to 36 inches were imploded under short-term and cyclic external pressure loading. Collapse pressure and recommended operational depth data are presented for one-way trip, round-trip, and cyclical applications. Recommendations for end-closure systems are also presented. One prototype light design and one prototype instrument housing design are described. Author (TAB)

N69-30370 Laboratorio de Acustica e Sonica, San Paulo (Brazil).
ULTRASONIC INSPECTION OF HIGH PRESSURE TUBE WELDING [INSPECAO ULTRA-SONICA DE UMA SOLDAGEM EM TUBO ALTA PRESSAO]
L. X. Nepomuceno, C. Mendonca Filho, H. Onusic, and W. P. Monteiro 12 Nov. 1968 4 p ref In PORTUGUESE; ENGLISH summary
(TN-6811.350) Avail: CFSTI

A brief description of the scope, procedures, equipment, and accessories used is presented, and the results of the ultrasonic inspection of the welding is included. Author

N69-30372# Army Mobility Equipment Command, Fort Belvoir, Va.
NOMINAL 24,000-BTU/hr AIR-TO-AIR THERMOELECTRIC ENVIRONMENTAL CONTROL UNIT Interim Report
Franklyn P. Good, Jr. Feb. 1969 22 p
(AD-684928; USAMERDC-1939) Avail: CFSTI CSCL 13/1

The report presents the facts and conclusions of acceptance tests performed at U. S. Army Mobility Equipment Research and Development Center on the nominal 24,000-Btu/hr air-to-air thermoelectric environmental control unit (TECU) built by Westinghouse Electric Corporation. The TECU is a self-contained, solid-state, heating-cooling device intended for application in controlling electronic van and shelter environment. Author (TAB)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N69-29022# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CERTAIN CHARACTERISTICS OF A FIBER OPTICS LASER
Sh. Sh. Gyatua et al Oct. 1968 6 p refs Transl. into ENGLISH From Soobshcheniya Akad. Nauk Gruzin. SSR (Tiflis), v. 49, no. 3, 1968 p 557-559
(AD-684670; FTD-GT-23-895-68) Avail: CFSTI CSCL 20/5

Stimulated emission in fiber bundles containing an arbitrary number of fibers, and the dependence of radiation halfwidth on the pumping energy for both single and bundled fibers, are investigated. It was found that as the pumping energy increases, so do the number of spikes, the emission intensity, and the halfwidth of the emission lines. When individual fibers were assembled into bundles the spikes disappeared. Stimulated emission traces for one fiber and for 8- and 20-fiber bundles displayed a continuous flat line with peaks leveled off; the pumping theshold remained constant and radiation intensity increased in proportion to the number of fibers. For a large bundle of fibers, the rings were washed out and the modes were not resolved, but the halfwidth of the radiation lines remained within the same range. Individual modes could not be resolved even with zero-order interference. It is concluded that the emission from single fibers and from fiber bundles is the same and of a stimulated nature. TAB

N69-29055 Illinois Univ., Urbana.
DISPERSION EFFECTS IN A HIGH GAIN 3.39 μ He–Ne LASER; APPLICATION TO THE LASER HETERODYNE MEASUREMENT OF PLASMA DENSITY
Chi-Sheng Liu (Ph.D. Thesis) 1968 93 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 69-1385

A He–Ne laser heterodyne system was utilized to evaluate the dispersive effect at 3.39μ in a He–Ne laser. The dispersion introduced by lasering atoms at 3.39 μ was measured as a function of cavity loss, excitation level, and deviation of the laser frequency from line center. Theoretical and experimental results were compared, and close agreement was obtained if the natural line width was taken to be 115 MHz and the Doppler line width was taken to be 315 MHz for the 3.39μ transition. The evaluation of the dispersive effect at 3.39μ was then used in the laser heterodyne measurement of plasma density using a three wave length He–Ne laser. Temporally and spatially resolved electron number densities in the range 2×10^{11} to 3×10^{12} cm^{-3} were measured in the afterglow of an argon plasma. Dissert. Abstr.

N69-29146# Library of Congress, Washington, D.C. Aerospace Technology Div.
FOREIGN LASER ABSTRACTS, VOLUME 2, NUMBER 3, 1969 Surveys of Foreign Scientific and Technical Literature
Mar. 1969 114 p
(AD-684148; ATD-69-88-Vol-2-No-3) Avail: Issuing Activity CSCL 20/5

Contents: Gas; Molecular beam; Glass; Semiconductor; Paramagnetic crystals; Liquid or organic media; Emission characteristics-generation dynamics; Spectroscopy of laser materials Components; Nonlinear optics; Interaction of light energy with matter; Interaction of laser beam with atmosphere; and Applications. TAB

N69-29245 Stanford Univ., Calif.
ELECTRO-OPTIC FREQUENCY TUNING AND REPETITIVE PULSING OF A Nd:YAG LASER
Duane Gregory Carlson (Ph.D. Thesis) 1968 66 p
Avail: Univ. Microfilms: HC $3.80/Microfilm $3.00 Order No. 69-204

Lasers of this type have previously been operated in a repetitive pulse mode using cw laser pumping with either a rotating-prism and mirror or an intracavity Pockels cell. The alternative and potentially advantageous system for the generation of laser pulses at Kilocycle repetition rates considered here is repetitive pulsing of the laser pump lamp. The system was analyzed for the case of a rectangular pump pulse. It was shown that the peak laser power is linearly proportional to the pulsed pump power, and the laser pulse width and the laser pulse delay are inversely proportional to the square root of the pulsed pump power. The laser peak pulse power and pulse width in the conventional Q-switched Dissert. Abstr.

N69-29759# Oregon Univ., Portland. Graduate Center for Study and Research.
MULTIWAVELENGTH LASER PROPAGATION STUDY Quarterly Progress Report, 15 Dec. 1968–15 Mar. 1969
J. Richard Kerr Apr. 1969 16 p refs
(Contract N00014-68-A-0461; ARPA Order 306)
(AD-685383; Rept-1154-3; QPR-3) Avail: CFSTI CSCL 20/5

The major objective of this program is to experimentally investigate the wavelength-dependence of turbulence effects on optical propagation through the atmosphere, and to relate the results to certain meteorological parameters, theoretical models, and model-independent dimensional analyses. During the third period, the laser, optical, and electronics systems were installed at the new field facility, and successful multiwavelength operation of the overall system was demonstrated. A technique was developed for rapid pointing of the infrared transmitter beams, and other experimental problems were identified and corrected. The resultant facility is uniquely suited to the investigation of the wavelength-dependence of scintillation and saturation, the range of validity of the existing analyses, and the conditions under which the commonly-accepted atmospheric models become inapplicable. Author (TAB)

N69-29669# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FIELD TESTS OF GAS LASER OPTICAL RANGEFINDERS
A. V. Gordeev et al 19 Aug. 1968 18 p refs Transl. into ENGLISH from Geodez i Kartograf. (Moscow), no. 12, 1967 p 7-13
(AD-685509; FTD-MT-24-205-68) Avail: CFSTI CSCL 8/5

The standard measurements program consisted of four observations of the minimum intensity of the signal. In order to compare signal display methods, each reading was made manually and by automatic modulation frequency control. Frequency modulation

readings were made in 4 seconds during both manual and automatic operation, irrespective of the distance measured. During the tests, the SVV-1 range-finder reflector system with a 30 in. divergence angle was used. Distances greater than 15 km were measured using two stacked reflectors. The distance measurements were checked on two base-lines 5.9 and 15.8 km long, respectively. The shorter base line was additionally measured by breakdown into several parts. The results of the control measurements over lines of varying lengths and at different hours are given in tabular form. The difference in the results between the manual and automatic measurement value over the 5 - 9 km base-line is significant (17 mm). This may be due to errors in the readout of the minimum signal intensity on the automatic mode. An analysis of measurement data indicates that the use of a laser combined with an interference light filter in the receiver permits wider use of the instrument for daylight measurements. Distances up to 20 km were measured during sunny days. The light filter pass band was 80A with a transmission coefficient of 0.3 at maximum response. The use of laser range-finders for measurements of distances shorter than 10 km permits their utilization during the most adverse weather conditions. A laser light source makes it possible to increase the nighttime range of the instrument to 30 km. Author (TAB)

N69-29916# Library of Congress, Washington, D.C. Aerospace Technology Div.

FOREIGN LASER ABSTRACTS, VOLUME 2, NUMBER 4, APRIL 1969 Surveys of Foreign Scientific and Technical Literature

Apr. 1969 141 p

(AD-685409; ATD-69-74-Vol-2-No-4) Avail: CFSTI CSCL 20/5

The publication is intended to bring together the current laser research published in the open-source scientific and technical literature of the Soviet Bloc countries. All materials included for presentation are under the following subject headings: Gas; Molecular beam; Glass; Semiconductor; Paramagnetic crystal; Liquid or organic media; Emission characteristics-generation dynamics; Spectroscopy of laser materials; Components; Nonlinear optics; Interaction of light energy with matter; Interaction of laser beam with atmosphere; and Applications. TAB

N69-29934*# Raytheon Co., Waltham, Mass.

A PROGRAM TO EVALUATE DYE LASERS AS HIGH POWER, PULSED, VISIBLE LIGHT SOURCES

Michael Bass, Thomas Deutsch, and Marvin Weber Washington NASA 11Jul. 1969 81 p refs

(Contract NAS12-635)

(NASA-CR-1374; S-1112) Avail: CFSTI CSCL 20E

Experimental and theoretical efforts to understand dye laser operation are discussed. The approach used by McCumber for treating phonon-terminated lasers was applied to investigate the gain properties of dye lasers and was extended to include effects arising from population buildup in the triplet-level system and associated triplet–triplet absorptive losses. The gain is expressed in terms of time-dependent excited-state populations, spectral emission, and/or absorption functions. For a given optical-pump pulse, a computer program was used to solve rate equations for the populations up to threshold and to calculate the gain as a function of time and frequency. The gain varies with frequency over the broad fluorescence bands characteristic of dye molecules and with time until the threshold for laser action is reached. Experiments using rhodamine 6G verify the predicted dependence of the laser frequency and time of threshold on cavity Q and demonstrate laser frequency tuning by adjusting the opening time of an intracavity Q switch. Author

N69-30220# United Aircraft Corp., East Hartford, Conn. Research Labs.

RESEARCH INVESTIGATION OF LASER LINE PROFILES (PICOSECOND LASER PULSES) Annual Report, 1 Aug. 1968–31 Mar. 1969

Anthony J. DeMaria, William H. Glenn, Jr., George L. Lamb, Jr., Michael E. Mack, and E. Brian Treacy Mar. 1969 97 p refs

(Contract N00014-68-C-0344; ARPA Order 306)

(AD-685607; H920479-13; AR-3) Avail: CFSTI CSCL 20/5

Topics discussed include theoretical and experimental work made on the propagation of ultrashort light pulses, stimulated thermal scattering effects, nonlinear propagation, adiabatic inversion of quantum states and organic dye lasers. Author (TAB)

N69-30268# Technische Hochschule in Wien (Austria). Institut fuer Hochfrequenztechnik.

LASER APPLICATIONS IN COMMUNICATIONS TECHNOLOGY Final Report, 1966–1968 [DIE ANWENDUNG DES LASERS IN DER NACHRICHTENTECNIK. Abschlussbericht, 1966–1968]

G. Schiffner, W. Laeb, H. Kindl, and G. Koepf 1968 140 p refs In GERMAN

(L8) Avail: CFSTI

The development and the construction of helium–neon, ruby, and CO_2 lasers are first described. This is followed by an account of experimental studies to determine laser emission effects on the discharge current of CO_2 lasers, dependence of the discharge current on the He–Ne laser emission, production of giant impulses with ruby and CO_2 lasers, and He–Ne lasers at 6401 Å, in monofrequency operation, and with axial magnetic fields. Theoretical and experimental work was conducted on information transmission by laser beams. The related field of optical communication is dealt with, including holography, granulation, nonlinear optical effects, and optical resonators. The equipment developed for the experimental work is described. This includes a transistorized net transformer, a photomultiplier, and a stabilized Michelson resonator. Transl. by K.W.

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N69-29020# Oak Ridge National Lab., Tenn. Isotopes Development Center.

STRONTIUM-90 DATA SHEETS

S. J. Rimshaw and E. E. Ketchen Mar. 1969 49 p refs

(Contract W-7405-Eng-26)

(ORNL-4358) Avail: CFSTI

Data are given for composition and various properties of ^{90}Sr metal, strontium titanate, strontium oxide, strontium fluoride, and strontium orthotitanate. The information presented includes: composition, specific power, radiation, critical mass, compatibility with materials of containment, thermophysical properties, mechanical properties, chemical properties, biological tolerances, and shielding data. NSA

N69-29026# Charles River Associates, Inc., Cambridge, Mass.

ECONOMIC ANALYSIS OF THE TUNGSTEN INDUSTRY

Jan. 1969 326 p refs

(Contract GS-OO-DS-(P)-85005)

(PB-182697) Avail: CFSTI CSCL 05C

The study describes and analyzes the behavior of the price of tungsten, its production, and consumption. The study includes an examination of short-and long-run supply and demand response, as well as the determinants of stock formation and of secondary production. Author (USGRDR)

N69-29029# Charles River Associates, Inc., Cambridge, Mass.
ECONOMIC ANALYSIS OF THE PLATINUM GROUP METALS
Dec. 1968 132 p
(Contract GS-OO-DS-(P)-85008)
(PB-182695) Avail: CFSTI CSCL 05C

The study focuses on platinum and palladium as they are by far the most abundant and important metals of the group and there appears to be very little information available about the economics of the four minor metals. The substantive portions of the report begin with a discussion of consumption of the metals. Both a technical description of the various uses of the platinum metals and a discussion of postwar trends in consumption are provided. A discussion is presented on the supply of the metals from the ore-producing countries to the refiners to the distributors. The organization is discussed of the platinum metals group industry, covering concentration and barriers to entry, the little that is known about cost of production and pricing policy, and recent higher merchants' prices for platinum. An econometric analysis of platinum and palladium is given. Author (USGRDR)

N69-29068# Charles River Associates, Inc., Cambridge, Mass.
ECONOMIC ANALYSIS OF THE NICKEL INDUSTRY
Dec. 1968 268 p refs
(Contract GS-OO-DS-(P)-85005)
(PB-182696) Avail: CFSTI CSCL 05C

The study is devoted to analysis of those aspects of the nikel industry which are germane to the determination of nickel pricing, supply, and demand. While primary emphasis is on the domestic market and its main sources of supply, these are considered in the larger context of the world market. The substantive portion of this report is organized in five chapters, dealing successively with demand, production, industry organization, pricing, and lastly an econometric model of price determination. Author (USGRDR)

N69-29163# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NEWS OF THE ACADEMY OF SCIENCES OF THE USSR METALS, NUMBER 1, 1968. SELECTED ARTICLES
A. M. Zakharov et al Oct. 1968 46 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Metal. (USSR), no. 1, 1968 p 162–169, 176–191
(AD-684050; FTD-MT-24-301-68) Avail: CFSTI CSCL 11/6

Contents: Investigation of structural diagram of an Mo-Ti-C system in a molybdenum rich region; Phase equilibriums in a Ti-Al-V system; and Structural diagram of a Zr-Ta-V system. TAB

N69-29389# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
QUALITY OF ULTRATHIN TITANIUM STRIP
G. P. Kalinin et al 8 Nov. 1968 7 p refs Transl. into ENGLISH from Tsvetn. Metal. (Moscow), no. 7, 1967 p 100–101
(AD-684046; FTD-HT-23-474-68) Avail: CFSTI CSCL 11/6

The work outlines the results of investigation of the rolling of titanium of various degrees of purity into ultrathin (0.005 mm) strip. Author (TAB)

N69-29389*# National Aeronautics and Space Administration, Washington, D. C.
INTERNAL OXIDATION OF NICKEL ALLOYS CONTAINING A SMALL AMOUNT OF CHROMIUM
Shoji Goto et al Jun. 1969 p 23 p refs Transl. into ENGLISH from J. Japan Inst. Metals (Sendai), v. 31, no. 4, 1967 p 600-606
(NASA-TT-F-12276) Avail: CFSTI CSCL 11F

A dilute solid solution of nickel containing chromium up to 4 wt% in the form of a plate was internally oxidized at temperatures between 900° and 1300°C for various times in order to investigate the growth and structure of the subscale formed. Some of the results obtained are as follows:(1) The relationship between the penetration depth of oxygen observed from the growth of the internally oxidized layer and the oxidation time of the alloys was well expressed by a parabolic law. (2) The activation energy for the growth of the internally oxidized layer decreased with increasing solute content in the alloys. (3) At high temperatures, the velocity of internal oxidation increased, and the relation between the temperature T and the penetration depth E was expressed by $E \propto T^2$. (4) The penetration depth E increased with increasing oxygen pressure. Author

N69-29430# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF HARDENING FROM THE ALPHA-ZONE AND SUBSEQUENT TEMPERING ON MECHANICAL PROPERTIES OF THE ALLOY VT5-1
B. A. Kolachev et al 24 Oct. 1968 18 p refs Transl. into ENGLISH from Tr. Aviats. Tekhn. Inst. (Moscow), no. 66, 1966 p 103–113
(AD-684049; FTD-HT-23-1021-68) Avail: CFSTI CSCL 11/6

Heat treatment in the alpha-zone can substantially alter the mechanical propeties of a titanium alloy, annealed in the standard manner, and thereby, in a number of cases, eliminate rejection based on mechanical properties. The limits of strength and yield, as well as impact toughness, are the most significantly altered of all mechanical properties studied for alloy during hardening and tempering. Author (TAB)

N69-29476# Alabama Univ., University. Bureau of Engineering Research.
AN EVALUATION OF THE TOUGHNESS OF METALLIC MATERIALS BASED UPON ENERGY DISSIPATION Final Report
Edward J. Planz Oct. 1968 44 p refs
(Contract DAAH01-67-C-2090)
(AD-684958) Avail: CFSTI CSCL 11/6

On the evaluation of the toughness of metallic materials was an advancement of the state of the art. Because of the absence of oscillations, the oscilloscope trace was well delineated. As a result a correlation was made possible between actual mechanical test results and specific portions of the oscilloscope trace. Static tensile properties such as ultimate and yield load, and per cent elongation could be determined within experimental error from the oscilloscope trace. Author (TAB)

N69-29484# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Moscow (USSR). Institut Atomnoi Energii.
ELECTRICAL CHARACTERISTICS OF STRONGLY-ALLOYED p-n TRANSITIONS FROM ARSENIDE OF GALLIUM (RADIO INDUCED) [ELECKTRICHESKIE KHARAKTERISTIKI SILNOLEGIROVANNYKH PEREKHODOV IZ ARSENIDA GALLIYA (RADIASIONNYE IZMENIYA)]
1968 47 p refs in RUSSIAN
(IAE-1659) Avail: AEC Despository Libraries

The mechanism responsible for radio induced changes in electric properties in p–n transitions of highly alloyed gallium arsenides is described. Author (NSA)

N69-29601# Boeing Co., Renton, Wash. Commercial Airplane Div.

RELATIONSHIP BETWEEN COMPOSITION, MICROSTRUCTURE, AND STRESS CORROSION CRACKING IN TITANIUM ALLOYS

R. E. Curtis Oct. 1968 29 p refs

(Contract N00014-66-C-0365; ARPA Order 878)

(AD-685380; D6-23716) Avail: CFSTI CSCL 11/6

Four alpha titanium alloys and 11 alpha + beta titanium alloys were characterized to relate phase composition and associated microstructure to stress corrosion cracking (SCC). Of these alloys, only a low-interstitial, commercially pure alpha alloy (Ti-50A) was immune to SCC. Addition of oxygen, aluminum, or aluminum and tin restricted slip in the alpha phase and promoted stress corrosion susceptibility. Formation of ordered domains of Ti3(Al, Sn) further restricted slip and increased susceptibility. Stress corrosion resistance was improved by thermomechanical treatments that reduced alpha grain size or increased dislpcation density. Alpha-phase susceptibility is qualitatively related to the intensity of the stress field surrounding a dislocation pileup. Alloying with molybdenum and/or vanadium increased strength and often improved stress corrosion resistance. This is attributed to stabilization of the ductile beta phase. However, precipitation of a fine dispersion of alpha or omega in beta caused embrittlement and reduced the stress corrosion threshold. Intermetallic compound formation in alloys containing copper or silicon similarly promoted susceptibility. Thermomechanical processing of Ti-4Al-4Mo-2Sn-0.5Si limited the embrittlement, probably by refining Ti5Si3 particles in the beta phase. Author (TAB)

N69-29650*# Sylvania Electric Products, Inc., Hicksville, N.Y. High Temperature Composites Lab.

DEVELOPMENT OF DUCTILE CLADDING FOR TD-NICKEL TURBINE VANE APPLICATIONS Final Report, 5 Jul. 1967–31 Dec. 1968

L. Sama, Dean D. Lawthers, and G. T. Pepino 31 Dec. 1968 145 p refs

(Contract NAS3-10489)

(NASA-CR-72521) Avail: CFSTI CSCL 11F

Slurry techniques were used to apply ductile 5 mil thick Ni–Cr–Al–Si coatings to TD-Ni ni and TD–NiCr. Single step coatings could not be fused uniformly thick around edges and corners. A two-step process, Ni–Cr–Si in the first and A1–20Co 20Cp in the second, was developed and proved more successful in protecting TD–Ni and TD–NiCr from oxidation. The systems protected TD–Ni for over 200 hours and TD-NiCr NiCr for over 350 hours at 2300°F. Coatings on TD–Ni were brittle as-coated but caused no substrate embrittlement. Coatings on TD–NiCr embrittled the substrate. After 100 hours at 2300°F, both coated materials could be bent cold over a 4 T radius. Electron probe analyses were obtained before and after exposure to argon diffusion or oxidation at 2300°F. Author

N69-29758# Boeing Co., Renton, Wash. Commercial Airplane Div.

METHANOL CRACKING OF TITANIUM 8Al-1Mo-1V

Daniel N. Fager Oct. 1968 6 p refs

(Contract N00014-66-C-0365; ARPA Order 878)

(AD-685381; D6-23717) Avail: CFSTI CSCL 11/6

A comparison is made between methanol and salt-solution cracking of Ti-8Al-1Mo-1V. Cracking characteristics are similar in that the beta and martensite phases have higher resistance and cleavage in the alpha phase must occur near the basal plane in both environments. It is suggested that, although cracking occurs at a lower stress level in methanol, some step in the cleavage process is slower than in salt solution. Author (TAB)

N69-29814# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MEASURING OF THERMAL CONDUCTIVITY OF METALS AT HIGH TEMPERATURE

V. E. Ivanov Oct. 1968 18 p refs Transl. into ENGLISH from the Publ."Eksperimentalnaya Tekhnika i Metody Vysokotemperaturnykh Izmerenii" Moscow, Izd. AN SSSR, 1966 p 30-37

(AD-685424; FTD-MT-24-354-68) Avail: CFSTI CSCL 11/6

The proposed method of thermal conductivity determinstion is free of radiative loss and changes in temp. gradient occurring in the measurement. The method permits the measurement of thermal conductivity in samples of simple geometrical form up to temperatures of failure. The thermal conductivity coefficient of Nb was measured at 1000-1600C. The electrical resistivity of Nb increases from 56 at 1000C to 74.7 microhm-cm. at 1600C. Author (TAB)

N69-29882# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MUTUAL DIFFUSION OF NIOBIUM AND METALS OF THE IVa, Va, VIa GROUPS

D. A. Prokoshkin, E. V. Vasileva, and L. L. Vergasova Nov. 1968 9 p refs Transl. into ENGLISH from Fiz. Metal. i Metalloved. (USSR), v. 23, no. 6, 1967 p 1134-1138

(AD-685007; FTD-HT-23-967-68) Avail: CFSTI CSCL 11/6

The mutual diffusion between niobium and metals of groups IVa, Va, and VIa was investigated. Specimens of vacuum-melted 99.9% pure titanium, zirconium, vanadium, tantalum, molybdenum, and tungsten were ground, polished, clamped with similarly treated niobium specimens, and annealed in a vacuum at 1300C for 100 hr. Metals having a lower melting temperature than niobium exhibited a higher diffusion mobility than the latter and a more intensive penetration into Nb while Nb diffused in these metals only slightly. TAB

N69-29884# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

SOVIET METALLURGICAL MACHINE BUILDING OVER THE LAST 50 YEARS

A. I. Tselikov Dec. 1968 20 p Transl. into ENGLISH from Vestn. Marshinostr. (Moscow), v. 47, no. 11, 1967 p 28-34

(AD-685010; FTD-HT-23-1037-68) Avail: CFSTI CSCL 11/6

Short histories are given of the various fields in metallurgical machine building, i.e., concentrating equipment, mechanical equipment for coke furnaces, blast furnaces and steel furnaces, machines for continuous metal casting, rolling, pipe and drawing mills, and heavy forge-press equipment. Author (TAB)

N69-29885# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ELASTIC STUDY OF ATOMIC CONFIGURATIONS OF INTERSTITIAL IMPURITIES IN BODY-CENTERED CUBIC METALS

Chen-Chu Yang Jul. 1968 36 p refs Transl. into ENGLISH From Wu Li Hsueh Pao (Peking), v.22, no.3, 1966 p 281-293

(AD-614989; FTD-HT-23-325-68) Avail: CFSTI CSCL 11/6

Assuming metals to be isotropic, infinitely large, homogeneous, and continuous elastic media, the tetrahedral and octahedral position energies of such interstitial impurity atoms as C, N, O, and H in body-centered cubic metals Fe, W, Mo, Ta, and Nb are calculated by using the concept of the elastic dipole. Calculation results show that the remaining atoms are all located at octahedral positions, except that H occupies the tetrahedral position in W, Mo, Ta, and Nb. Also, a critical radius has been found to determine whether interstitial atoms are in the tetrahedral or the octahedral position. In the last part, activation energy for diffusion of interstitial atoms among octahedral sites is calculated, and results obtained all rather closely agree with previous workers experimental data.
Author (TAB)

N69-29920# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTRON-BEAM WELDING OF MOLYBDENUM WITH NIOBIUM AND MOLYBDENUM WITH STAINLESS STEEL Kh18-N10T
G. V. Terebikhin 11 Oct. 1968 19 p refs Transl. into ENGLISH from Tr. Politekhnicheski Inst. (Leningrad), no. 283, 1967 p 157–164
(AD-685541; FTD-MT-24-251-68) Avail: CFSTI CSCL 11/6

The report discusses experimental methods of welding molybdenum and niobium to each other and to stainless steel.
TAB

N69-29930# Technische Hochschule Hannover (West Germany). Fakultaet fuer Maschinenwesen.
MATERIAL BEHAVIOR AND RESIDUAL STRESS CONDITION FOLLOWING AUSTENITE FORM HARDENING [WERKSTOFFVERHALTEN UND EIGENSPANNUNGSZUSTAND NACH DEM AUSTENITFORMHAERTEN]
Joachim Burmester (Ph.D. Thesis) 1968 138 p refs In GERMAN
Avail: CFSTI

Mechanical and fatigue properties of ausformed steel are studied through the formation mechanism of secondary hardness and its dependence on carbide distribution and structure in the metal matrix. Residual stress measurements during martensitic transformation show that thermal shrinkage stress minimizes crack formation; low transformation temperatures and slow cooling processes should be avoided during the ausforming process in order to reduce residual stress content.
Transl. by G.G.

N69-29989# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.
DIFFUSION WELDING [SOUDAGE PAR DIFFUSION]
Joël Danisult and René Gillet Mar. 1969 44 p refs In FRENCH; ENGLISH summary
(CEA-R-3675) Avail: CFSTI

After a brief review of the principles, and advantages of the method, some examples of metallic bonding are given and some preliminary trials on Ta-Mo, Zr-Zr, Zr-Nb, Nb-stainless steel, Mo-stainless steel aluminum-aluminum (A5-A5) are described. The remainder of the note is devoted to trials on construction elements e.g. tabular elements for bonding between Mo or Nb on one hand, and stainless steel on the other hand. Conditions for tight bonding are indicated along with mechanical strengths and resistance to thermal cycles. Methods for obtaining Be-radiation windows welded to an element of stainless steel are also considered.
Author (ESRO)

N69-29990*# Virginia Polytechnic Inst., Blacksburg.
AN ANALYSIS OF THE TRANSIENT BEHAVIOR OF INFILTRATED TUNGSTEN COMPOSITES INCLUDING THE EFFECT OF THE MELT LAYER Final Report
Martin Crawford, F. B. Gessner, and Maurice R. Berry, Jr. Mar. 1969 134 p refs
(GRANT NGR-47-004-006; VPI Proj. 313157)
(NASA-CR-103231; SAPR-8) Avail: CFSTI CSCL 11F

A detailed analytical model was developed to include the effect of the melting process on a porous composite which retards its own heating rate by sacrificing its infiltrant. A transient one-dimensional heat transfer analysis was conducted considering both the heats absorbed by melting and vaporization of the infiltrant from within the matrix. A finite-thickness liquid layer was seen to exist above the composite surface as a result of the flow of liquid coolant onto the surface induced by the expansion of the coolant on melting. There existed a period of time during which the melt layer was subject to both depletion due to vaporization and renewal by the flow of liquid coolant onto the surface. As the heating process continued, the melt layer was depleted and the liquid coolant vaporized from within the tungsten matrix. Author

N69-29997# Electrotechnical Lab., Tokyo (Japan).
THEORY OF DILUTE MAGNETIC ALLOYS
Jun Kondo Sep. 1968 84 p refs
(Rept-688) Avail: CFSTI

Theoretical investigation on a localized spin incorporated into a metal is presented. An exchange interaction between the localized spin and the conduction electrons is assumed, and various properties of the metal caused by this interaction is calculated. Included in the presentations are the lowest and the highest order perturbations, and impurity atom possession of a magnetic moment in a metal. It is shown that many physical parameters involved a log T term. The difficulty caused by the log T term is studied. It is also shown that more refined theories can be provided which are free from difficulty and predictions can be made at low temperature.
Author

N69-30117# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Metal Physics Branch.
PHYSICAL FEATURES IN THE INTERACTIONS OF POINT DEFECTS IN METALS WITH SPECIAL REFERENCE TO ZIRCONIUM
G. R. Piercy Nov. 1968 19 p refs
(AECL-3227) Avail: Atomic Energy of Can., Ltd., Chalk River: $ 50

The physical arguments behind the present understanding of the interaction between different solute atoms and vacancies are described in a qualitative manner. Application of these to zirconium indicates that a rare-earth solute may have the large interaction with vacancies that could reduce the in-reactor creep rate by acting as a vacancy-interstitial recombination center, or improve the high temperature mechanical properties by forming a stable precipitate.
Author

N69-30132# Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires.
THE STABILIZATION OF MIXED CARBIDES OF URANIUM-PLUTONIUM BY ZIRCONIUM. PART 1: URANIUM CARBIDE WITH SMALL ADDITIONS OF ZIRCONIUM [ETUDE DE LA STABILISATION DES CARBURES MIXTES D'URANIUM ET DE PLUTONIUM PAR ADDITION DE ZIRCONIUM. PREMIERE PARTIE: ETUDE DES CARBURES D'URANIUM AVEC DE FAIBLES ADDITIONS DE ZIRCONIUM]

Shimon Backer Mar. 1969 65 p refs In FRENCH; ENGLISH summary
(CEA-R-3765) Avail: CFSTI

Cast carbide samples, being of a high density and purity, are preferable for research purposes, to samples produced by powder metallurgy methods. Samples of uranium carbide with small additions of zirconium (1 to 5 per cent) were cast, as rods, in an arc furnace. A single phase carbide with interesting qualities was produced. As cast, a dendrite structure is observed, which does not disappear after 110 hours treatment at 1900°C. In comparison with uranium monocarbide the compatibility with stainless steel is much improved. The specific heat (between room temperature and 2500°C) is similar to the specific heat of uranium monocarbide. A study of mixed carbides having a part of the uranium replaced by plutonium is under way. Author (ESRO)

N69-30148# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
PROPERTIES AND PREPARATION OF HIGH-PURITY ALUMINUM
V. Arp [1968] 21 p refs Repr. From Proc. of the 1968 Summer Study on Superconducting Devices and Accelerators, pt. 3, Apr. 1969 p 1095–1114 refs
(Contract F33615-68-M-5000)
(R-513; BNL-50155; C-55) Avail: CFSTI

The properties of aluminum as related to the potential economy of using aluminum magnets operating at low temperatures are summarized. Electrical and thermal conductivities are discussed, and data relevant to high purity composition are presented. Various contributions to dc resistivity, the quantitative relationship between electrical and thermal conductivities, and the response of metals under ac conditions are treated. Finally, the current availability of high purity aluminum in technologically useful quantities is reported. A.C.R.

N69-30165# Atomic Energy Commission Research Establishment, Riso (Denmark). Physics Dept.
THE COEXISTENCE OF THE COMMENSURATE AND OSCILLATORY MAGNETIC PHASES IN CHROMIUM ALLOYS
B. Lebech and K. Mikke Nov. 1968 12 p refs
(RISO-M-811) Avail: CFSTI

Detailed neutron diffraction investigations were performed for Cr-Re alloys in which the coexistence of a commensurate and an oscillatory magnetic phase was reported earlier. It is shown that a more reasonable assumption is the occurrence of the individual magnetic phases in separate domains. Author (ESRO)

N69-30174# Boeing Scientific Research Labs., Seattle, Wash. Solid State Physics Lab.
DIELECTRIC PROPERTIES OF SURFACE OXIDES ON ALUMINUM
S. H. A. Begemann (Tech. Phys. Lab, Univ. Complex Paddepoel, Groningen, Netherlands) and A. W. Smith Feb. 1969 65 p refs
(AD-685577; D1-82-0824) Avail: CFSTI CSCL 11/3

Dielectric property measurements have been performed on various types of aluminum surface oxides. The results, obtained with different electrode materials are interpreted by analogy with a series parallel network of capacitors and resistors. Author (TAB)

N69-30199# Naval Research Lab., Washington, D. C.
ARPA COUPLING PROGRAM ON STRESS-CORROSION CRACKING Quarterly Report
E. P. Dahlberg Jan. 1969 46 p refs
(ARPA Order 878)
(AD-685590; NRL-MR-1965; QR-8) Avail: CFSTI CSCL 11/6

The report contains a compilation of abstracts from recently published reports and journal articles generated under the ARPA Coupling Program on Stress-Corrosion Cracking, ARPA Order 878. Selected abstracts of articles from outside the ARPA program in the field of stress-corrosion cracking and a diary of events are also included. Author (TAB)

N69-30200# Naval Research Lab., Washington, D.C. Physical Metallurgy Branch.
MARINE CORROSION STUDIES: CHARACTERIZATION OF THE CORROSION BEHAVIOR AND RESPONSE TO CATHODIC PROTECTION OF NINETEEN ALUMINUM ALLOYS IN SEA WATER Interim Progress Report
R. E. Groover, T. J. Lennox, Jr., and M. H. Peterson Jan. 1969 27 p refs
(AD-685588; NRL-MR-1981; IPR-7) Avail: CFSTI CSCL 11/6

The corrosion characteristics of nineteen structural aluminum alloys were studied in quiescent sea water. Some alloys were exposed with and without cladding, and others at more than one strength level for a total of twenty-six material conditions. The response to cathodic protection of all the alloys studied was also determined. The electrochemical potentials of the alloys were monitored during the experiment and a relationship was developed between the electrode potential and the corrosion characteristics of the alloys. Author (TAB)

N69-30253# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A THERMODYNAMIC ANALYSIS OF THE CONDITIONS FOR THE ROLLING OF TUNGSTEN IN THE VACUUM AT HIGH TEMPERATURES, WITHOUT OXIDATION
A. N. Krestovnikov et al 11 Sep. 1968 15 p refs Transl. into ENGLISH from Sb. Inst. Stali i Splavov (Moscow), no. 41, 1966 p 196-204
(AD-685086; FTD-HT-23-296-68) Avail: CFSTI CSCL 11/6

Thermochemical calculations of tungsten behavior at various temperatures and residual pressures and conditions under which oxidation cannot occur are presented. The characteristic temperatures of the oxides are given and the Debye functions for tungsten and oxygen are tabulated. Based on this data, curves of the isobaric potentials for oxide formation and of the equilibrium pressures of oxygen as a function of temperature are constructed. Author (TAB)

N69-30371# Aerojet-General Corp., Sacramento, Calif. Materials Research Lab.
TERNARY PHASE EQUILIBRIA IN TRANSITION METAL BORON CARBON SILICON SYSTEMS. Part 2: TERNARY SYSTEMS. Volume 18: CONSTITUTION OF NIOBIUM TUNGSTEN CARBON ALLOYS
E. Rudy Wright-Patterson AFB, Ohio AFML Jan. 1969 76 p refs
(Contract AF 33(615)-1249)
(AD-685186; AFML-TR-65-2-Pt-2-Vol-18) Avail: CFSTI CSCL 11/6

The ternary alloy system niobium-tungsten-carbon was investigated by means of X-ray, melting point, DTA, and metallographic techniques on chemically and thermally defined specimens. A phase diagram from 1500C through the melting range was established. The solid state equilibria in the system are characterized by limited metal exchanges in the subcarbides and the occurrence of a two-phase equilibrium between the monocarbide

and the metal phase. Above 2530C, niobium monocarbide and the cubic high temperature phase in the W-C system form an uninterrupted series of solid solutions; below this temperature, the tungsten exchange in NbC is temperature-dependent and decreases to approximately 25 At% W at 1500C. The tungsten exchange in Nb2C is less than 5 At% at all temperatures, whereas the solubility in W2C increases from 24 mole% Nb2C at 1500C, to a maximum of approximately 37 mole% Nb2C at 2600C. The order-disorder reaction, as well as the change-of-order transition, temperature in W2C and Nb2C are lowered by niobium additions, but the details of the transition reactions in the ternary could not be delineated. Five isothermal reactions, all of which involve a liquid phase, occur in the system. Two correspond to limiting tie lines and the remaining three are class II (two-over-two) ternary reactions. The results of this phase diagram investigation are discussed and the phase equilibria thermodynamically analyzed and interpreted. Author (TAB)

N69-30392# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE HYDROMECHANICAL EXTRUSION OF THIN-WALLED TUBES
V. I. Zalesskii et al. Jul. 1968. 15 p. refs. Transl. into ENGLISH of Kuznechno-Shtampovochnoe Proizv. (USSR), v. 9, no. 4, 1967 p. 1-4
(AD-685136; FTD-HT-23-274-68) Avail: CFSTI CSCL 11/6

A nonuniform flow of metal takes place in hydrostatic extrusion of thin-wall tubes. One method of eliminating nonuniform metal flow is extrusion by direct action of a dummy block on the end of the billet, while its sides are supported by a highly compressed fluid. This process is called hydromechanical extrusion to distinguish it from purely hydrostatic extrusion. Author (TAB)

N69-30395# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETERMINATION OF THE OXYGEN, HYDROGEN AND NITROGEN CONTENT IN ALLOYS OF THE Ni-Mg AND Ni-Mg-W SYSTEM
T. A. Izmanova et al. Sep. 1968. 8 p. refs. Transl. into ENGLISH from Sb. Tr. Tsentr. Nauchn.-Issled. Inst. Chernoi Met. (USSR), no. 49, 1966 p. 94-97
(AD-685164; FTD-HT-23-302-68) Avail: CFSTI CSCL 11/6

The determination of O, H, and N in 8-10 g. of alloys containing Mg is carried out by vacuum fusion at 1700C with addn. of 2-3 g. metallic Pb. The temp. of extn. is 1650C for Ni-Mg alloys and 1700C for Ni-Mg-W alloys. Author (TAB)

N69-30397# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
POWDER MATERIALS
B. I. Matveev. Aug. 1968. 22 p. Transl. into ENGLISH from Tsvetn. Metal. i Splavy (Moscow), 1967 p. 102-112
(AD-685063; FTD-MT-24-307-68) Avail: CFSTI CSCL 11/6

This article deals with the properties of sintered aluminum powder and sintered aluminum alloys. The author discusses their strength, corrosion resistance, heat resistance, machinability, weldability, production and their uses when applied to various industries. Author (TAB)

N69-30399# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SYSTEM OF AUTOMATIC MAINTENANCE OF TEMPERATURE OF BASE IN PRECIPITATING FILMS
B. M. Abakumov et al. 23 Jul. 1968. 9 p. Transl. into ENGLISH from Prib. Sist. UPR. (Moscow), no. 2, 1967 p. 33
(AD-685147; FTD-HT-23-384-68) Avail: CFSTI CSCL 11/6

In order to obtain magnetic thin films of constant characteristics, it is essential to maintain close control of the substrate temperature. The authors describe an automatic control unit which accomplishes this to a suitable degree. Author (TAB)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N69-29047# Linde Div., Union Carbide Corp., Indianapolis, Ind.
RESEARCH AND DEVELOPMENT IN A THERMAL INSULATION STUDY Progress Report, Sep.–Nov. 1968
W. E. Grunert. Nov. 1968. 71 p. refs
(Contract AT(30-1)-3632)
(PB-182644; ALO-3632-36) Avail: CFSTI

Results of long-term thermal conductivity tests on copper opacified and nickel opacified multi-layer insulations are up-dated. The 1800F nickel and Refrasil quartz instability problems are discussed in detail. Molybdenum and woven quartz cloth are recommended as alternate materials at this temperature. Apparent thermal conductivity data are presented for three nickel multi-foil insulations and the nickel opacified fibrous multilayer system. Thermal performance is correlated to temperature and compressive load. The resultant empirical thermal conductivity expressions are presented and applied. Longitudinal thermal conductivity data for aluminum opacified glass multi-layer insulations are given. Results of the exposed edge effects analytical and experimental program are presented and discussed. A Hastelloy-X specimen was analyzed in as-received condition and after 1400°F, 10,000-hour exposure. Pertinent results on vacuum integrity and material strength are given. Magnified surface photographs and photomicrographs are presented and discussed. USGRDR

N69-29186# Chicago Univ., Ill.
EXPANDED RESEARCH PROGRAM IN MATERIALS SCIENCES Annual Technical Report No. 7, 1 Jul. 1967–30 Jun. 1968
Dec. 1968. 80 p. refs
(Contract ARPA SD-89)
(AD-679760) Avail: CFSTI CSCL 11/7

The research performed by members of the Materials Sciences Faculty during the period 1967 July 1 to 1968 Jun 30 is summarized. All publications of each Material Sciences Faculty member and his colleagues, appearing during this same period, are listed. All research projects listed benefitted to some extent from services, equipment and central facilities provided by ARPA funding. TAB

N69-29224# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
POLYAMIDES AS ANTIFRICTION MATERIALS
M. I. Bessonov et al. Aug. 1968. 10 p. refs. Transl. into ENGLISH from Mekhan. Polimerov (USSR), no. 4, 1967 p. 740-742
(AD-684377; FTD-HT-23-497-68) Avail: CFSTI CSCL 11/8

The antifriction properties of a polyamide obtained by

polycondensation of pyromellitic anhydride and diaminodiphenyl ether were determined on films and coatings in sliding friction against polished steel. The relatively high thermal stability of the polyamide enables it to retain its physicomechanical and hence antifriction properties over a wide temperature range. Thin-layer polyamids on a metal support can be used as an antifriction material at sliding rates of 1 to 10 m/sec and loads of 80 to 100 kg/sq. cm. It is shown that polycaproamide cannot be used at high loads and sliding rates. Author (TAB)

N69-29338 Delaware Univ., Newark.
VISCOUS HEATING IN MODELS OF VISCOELASTIC MATERIALS WITH TEMPERATURE DEPENDENT VISCOSITY
George Eugene Mueller (Ph. D. Thesis) 1967 246 p
Univ. Microfilms: HCC $11.25/Microfilm $3.20 Order No. 69-1132

Whenever materials undergo deformations, a portion of the mechanical work is converted into thermal energy. Generally, several of the materials properties are temperature dependent and these effects should be included in the mathematical model of the deformation process. This results in a system in which the stress-strain equations are coupled to the energy equation by the relationships describing the temperature dependencies of those properties which are temperature dependent. For most real materials, the resulting set of equations are intractable and simplifying assumptions must be made. Thus, we consider the elementary models of materials: the viscous, the Maxwell, and the Kelvin-Voigt models. Combined thermal and geometric effects were studied by elongating and compressing viscous model cylinders having temperature dependent viscosity. Dissert. Abstr.

N69-29346*# ITT Research Inst., Chicago, Ill. Technology Center
DEVELOPMENT OF SPACE-STABLE THERMAL-CONTROL COATINGS Triannual Report, 1 Mar.–31 Aug. 1968
G. A. Zerlaut, M. Marcour, and G. Noble 25 Oct. 1968 86 p refs
(Contract NAS8-5379)
(NASA-CR-101580; ITTRI-U6002-69) Avail: CFSTI CSCL 11C

Preliminary results of continuing research are presented, with emphasis on initial electron spin resonance studies of zinc orthotitanate. Additional topics include a review of literature on the synthesis of new, potentially stable, white pigments; a description of the experimental synthesis of new pigment candidates and an examination of their stability to ultraviolet irradiation in vacuum; and a resume of the design, construction and assembly of a combined-environment-irradiation facility that employs the IRIF-II in situ reflectometer and a new, low-flux, low energy, proton gun. It was found that even though zinc orthotitanate exhibits many resonance signals when its ground-state defects are decorated with gamma radiation, the relative strengths of the signals are small, and the material appears to be generally stable. Also, theoretical analyses and experiments suggest that Group II and IIIB binary and ternary cation systems, such as the titanates, tungstates, stannates and double zirconium silicates, offer considerable potential for new space-adaptable pigments. A. C. R.

N69-29366# Department of Forestry, Vancouver (British Columbia). Forest Products Lab.
PROCESS DEVELOPMENT OF LARGE PHOTOELASTIC BI-REFRINGENT PLASTIC SHEETS
J. C. Bohlen Jun. 1968 14 p
(PB-182734; VP-X-40) Avail: CFSTI CSCL 11I

In order to determine the state of strain in complex-shaped wood structures (e. g. glued-laminated, tapered, and pitched beams) by the photoelastic technique, it is necessary to cover broad surface areas of a structure with bi-refringent plastic. Consequently, large sheets of plastic are required. Commercial sources of bi-refringent plastic offer limited sizes (10 in. x 10 in. maximum) due to the difficulty of fabricating larger sizes. By developing a system of mechanical mixing and then casting the liquid plastic on a precisely flat and level surface, 14 in. x 21 in. photoplastic sheets were obtained of optical quality and thickness tolerance at least equal to commercial products. Details of the development and experimental methods included here are sufficient for other researchers to duplicate the process. Author (USGRDR)

N69-29388*# ARA, Inc., West Covina, Calif.
NONDESTRUCTIVE TESTING OF ADHESIVE BONDS BY NUCLEAR QUADRUPOLE RESONANCE METHODS Final Report
Sep. 1968 72 p refs
(Contract NAS8-20675)
(NASA-CR-61988; ARA-69) Avail: CFSTI CSCL 11A

Initially, tests were made to determine whether the three adhesives had an inherent nuclear quadrupole resonance material such that the adhesive itself could be used without adding a tracer for evaluating the adhesive bond characteristics. Chemical analysis of the three adhesives found that only one could possibly have sufficient chlorine content to provide a nuclear quadrupole resonance. Upon thorough investigation, it was found that even this adhesive was found to be unsuitable for providing adequate signals of the NQR response. As a result, approximately one to three percent of copper oxide (by volume) was added to each of the adhesives to allow an for adequate signal to noise ratio of the NQR. Several types of specimens were made for each of the three adhesives. The first was a cylindrical rod from which excellent mechanical elasto-plastic properties were obtained under both axial tension and compression. Next, for each of the adhesives, laminates were made using either fiberglass sheets, aluminum sheets, or combinations of both. Finally, honeycomb types of structures were made using the three adhesives wherein the plastic and aluminum sheets were bonded to plastic and aluminum honeycombs for each of the three adhesives. Author

N69-29393# Defense Documentation Center, Alexandria, Va.
CERAMIC MATERIALS, VOLUME 8 Report Bibliography, Nov. 1964–Nov. 1968
Mar. 1969 123 p refs
(AD-685700; DDC-TAS-68-102) Avail: CFSTI CSCL 11/12

This bibliography is Volume VIII in a series of eight volumes and is composed of all the unclassified and unlimited references on Ceramic Materials. This volume contains seven parts which correspond to the subject titles of the following unclassified and limited volumes: Volume I, AD-851 500-Manufacturing and Processing of Ceramic Materials; Volume II, AD-851 501-Literature Survey and Symposiums on Ceramic Materials; Volume III, AD-851 502-Physical Properties of Ceramic Materials; Volume IV, AD-851 503-Chemical Properties of Ceramic Materials; Volume V, AD-851 504-Ceramic Coatings; Volume VI, AD-851 505-High Temperature Applications of Ceramic Materials; Volume VII, AD-851 506-The Use of Ceramic Materials in Electronic Devices. Author (TAB)

N69-29421# Idaho Nuclear Corp., Idaho Falls.
DEVELOPMENT OF TESTING PROCEDURES FOR PROTECTIVE COATINGS TO BE USED IN NUCLEAR REACTOR CONTAINMENT STRUCTURES
B. J. Newby, K. L. Rohde, and W. T. Gordan Feb. 1969 23 p refs
(Contract AT(01)-1330)
(IN-1263) Avail: CFSTI

Tests were designed to examine protective coatings for characteristics important in applications to the interior surfaces of boiling and pressurized water reactor containment structures. The experimental verfication of these tests also served to determine that there are coating systems available that contain all the desired physical and chemical characteristics. NSA

N69-29443*# Litton Systems, Inc. Beverly Hills, Calif. Applied Technology Div.
A PROGRAM TO EVALUATE THE POTENTIAL OF SPUTTERED COATINGS OF POLYCARBONATE SPACE HELMETS Final Report
Jan. 1969 19 p
(Contract NAS9-8268)
(NASA-CR-99697; Pub-11-69-245) Avail: CFSTI CSCL 11C

Coating of optically clear polycarbonate with a hard transparent material that would exhibit good adhesion with the substrate was studied. Alumina (Al_2O_3) was selected as the coating material because of its hardness and transparency and also because of its availability. A coating of 1.2 microns (12,000 Angstroms) was determined to be of sufficient thickness to provide good abrasion protection for polycarbonate, and application of the coating by sputtering resulted in a good bond between coating and substrate. Polycarbonate samples coated with 2 microns of alumina were subjected to flammability tests. The coating provided 48 seconds protection to polycarbonate in a silicone igniter test in 6.2 psia, 100 percent oxygen and 25 seconds to ignition in the same atmosphere during exposure to an 1800°F flame. Author

N69-29489 Boeing Co., Seattle, Wash.
PLASTICS FOR HEAVY DUTY REQUIREMENTS
H. Heissler 26 Aug. 1968 20 p refs Transl. into ENGLISH from German report no. WE-16-Oe Presented at 7th Seminar for Aerospace Technol., Braunschweig, West Ger., 7-11 Oct. 1963
(WE-16-Oe; H-184) Avail: CFSTI

High polymer materials used as loadbearing components are discussed which meet the exacting requirements of aeronautics and space technology. First the criteria used for evaluation, i.e. temperature effects over a broad range, and the oxidizing influence of flame exposure were emphasized. Then the molecular design of a polymer and its relation to the total performance as a thermoplastic, elastomeric, or thermosetting material was presented in tabular form, and the analysis applied to several commercial polymers. These consisted of polyimides, polybenzimidazoles, polybenthiazoles and polybutadines. M. H. E.

N69-29589*# Franklin Inst., Philadelphia, Pa. Research Labs.
ELECTRICAL CHARACTERISTICS OF PYRRONE POLYMERS
P. J. Reucroft, H. Scott, P. L. Kronick, and F. L. Serafin Washington Publ NASA Jun. 1969 58 p refs
(Contract NASI-7409)
(NASA-CR-1367) Avail: CFSTI

Polyimidazopyrrolone or Pyrrone polymers, a new class of aromatic-heterocyclic polymers which have outstanding thermal and radiolytic stability, are studied. A detailed determination of the alternating current and direct current electrical properties of Pyrrone polymers and the effect of high energy radiation on these properties are described. Author

N69-29590*# IIT Research Inst., Chicago, Ill. Technology Center.
DEVELOPMENT OF SPACE-STABLE THERMAL-CONTROL COATINGS Triennual Report, 1 Nov. 1967-29 Feb. 1968
G. A. Zerlaut and G. Noble 15 Apr. 1968 37 p refs
(Contract NAS8-5379; IITRI Proj. U6002)
(NASA-CR-102203; IITRI-U6002-63) Avail: CFSTI CSCL 11C

Potassium silicate and sodium acid phosphate encapsulation reduced zinc orthotitanate degradation during ultraviolet vacuum irradiation. Pigmentation in potassium silicate was most effective in preventing the formation of the broad, bleachable absorption band centered at about 800-mm wavelength that characterizes untreated zinc orthotitanate. Electromagnetic resonance spectra of trapped charges in zinc oxide powder seemed to indicate a very low symmetry. Silicate treatment of zinc oxide prevented the formation of magnetic centers by irradiation. G. G.

N69-29883*# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE NATURE OF DEFORMATION OF THE SURFACE LAYERS OF POLYMETHYLMETHACRYLATE UNDER FRICTION
A. I. Elkin and V. I. Titov Dec. 1968 12 p refs Transl. into ENGLISH from Mekh. Polimerov (USSR), no. 1, 1968 p 90-94
(AD-685009; FTD-HT-23-1048-68) Avail: CFSTI CSCL 11/9

The nature of deformation in surface layers of thermoplastic amorphous plastics during friction was studied. Friction was caused by sliding a spherical steel indentor over polymethylmetacrylate at various velocities. At low velocities, elastic and forced-elastic deformations occur in the surface layers and there is roughening of the plastic. The deformed surface layers regain their shape at temperatures corresponding to the highly elastic state. With increased sliding velocity, the forced-elastic deformation is localized in a finer layer. Beginning at some velocity, depending on the temperature and activation energy of the shift in polymer chain segments from one equilibrium position to another, a transition to a purely elastic deformation of the surface layers and roughening of the plastic occurs. Drastic destruction of the surface layer takes place in elastic deformation at pressures above a specified value. Photographs of the effects produced on the plastic are given, some of them made with polarized light. TAB

N69-29887*# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPLICATION OF POLYMERIC MATERIALS IN STRUCTURES OPERATING UNDER LOAD
P. M. Kozlov Jul. 1968 343 p refs Transl. into ENGLISH of Primenenie Polimernykh Materialov v Konstruktsiyakh Rabotayushchikh Pod Nagruzkoi (Moscow), 1966 p 1-361
(AD-684988; FTD-HT-23-277-68) Avail: CFSTI CSCL 11/9

The book is a presentation of the authors experience in the field of polymer technology. A number of important considerations are noted for approaching the problems of designing, testing, and manufacturing structural parts from plastics designed for operation under load. The behavior of plastics in various structures and conditions is studied in a great number of practical examples. Design calculations using deformation characteristics of plastic materials are presented. Author (TAB)

N69-29890*# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE INFLUENCE OF MOLECULAR WEIGHT ON DEFORMATION-STRENGTH PROPERTIES OF ORIENTED AMORPHOUS POLYMERS
L. A. Layus et al 11 Oct. 1968 19 p refs Transl. into ENGLISH from Mekhan. Polimerov (USSR), no. 4, 1967 p 579-585
(AD-685494; FTD-MT-24-314-68) Avail: CFSTI CSCL 11/5

Tensile tests were carried out on uniaxially oriented films of several amorphous linear polymers, i.e., polymethyl methacrylate, polystyrene, and poly-2, 2-octamethylene-5, 5-dibenzimidazole of

different molecular weights. In the range of relatively high molecular weights, the latter were shown to have no direct effect on the mechanical properties of isotropic and oriented polymers. The mechanical properties were determined by the network structure formed during the extension, and by the average degree of orientation of the macromolecular mers. It was concluded that the formation of a particular structure is closely related to the molecular weight of a polymer, and that a given molecular weight can promote or hinder the formation of the corresponding structure under given extension conditions. Author (TAB)

N69-29936# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE ROLE OF THE BONDING MEDIUM IN ELECTROLUMINESCENCE LAYERS

V. E. Solodkin and T. V. Eremeeva Jul. 1968 15 p refs Transl. into ENGLISH from Lakokrasochnye Materialy i ikh Primenenie (Leningrad), no. 1, 1967 p 19–22

(AD-684991; FTD-HT-23-344-68) Avail: CFSTI CSCL 11/1

The effect of such binding media as acetone, benzene, castor oil, glycerine, acetylcellulose, cyanethylcellulose, alpha naphthylsulfone, and nitrile of succinic acid on the brightness of electroluminescence condensors was investigated in detail. The experimental data confirmed the correctness of the Roberts equation correlating the brightness of the electroluminescence layers with the dielectric constant of the binding medium. It was found that one of the important roles played by the binding medium is to modify the field strength of the phosphorus. TAB

N69-29957# Stevens Inst. of Tech., Hoboken, N.J. Dept. of Chemistry and Chemical Engineering.

MECHANICAL BEHAVIOR OF POLYTETRAFLUOROETHYLENE AROUND THE ROOM TEMPERATURE FIRST ORDER TRANSITION

Rodney D. Andrews, George P. Koo Mar. 1969 41 p refs

(Contract N00014-68-A-0131)

(AD-686617; TR-6) Avail: CFSTI CSCL 11/9

The effect of the room temperature first order transition on the plastic yield behavior of polytetrafluoroethylene (PTFE) has been investigated. Stress-strain curves were measured at different strain rates and temperatures. Tensile creep under constant dead load was also measured as a function of temperature and stress level. The effect of degree of crystallinity was investigated by using both a rapidly quenched and slow cooled polymer. The curve of yield stress vs temperature in the temperature range from -50 to +68C was found to be almost identical with the curve of elastic modulus vs temperature: the yield stress shows a marked local decrease at the first order transition. The experimental observations suggest a model of the solid-state structure of PTFE which could be described as an elastic-plastic network, in which crystalline domains are connected by elastic amorphous regions, and in which the crystalline domains can flow plastically at sufficiently high stress or temperature. Author (TAB)

N69-29964# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EVALUATION OF ANISOTROPY IN GLASS-REINFORCED PLASTICS

R. Ya. Ivanova et al 10 Oct. 1968 14 p refs Transl. into ENGLISH from Sudostroyeniye (Leningrad), v. 57, no. 12, 1967 p 3–6

(AD-686503; FTD-HT-23-829-68) Avail: CFSTI CSCL 11/8

The anisotropy of the mechanical properties of fiber-glass plastic was investigated. The relationship between the maximum values of the shear modulus and the angle of inclination alpha as a function of the degree of reinforcing was also investigated on the basis of published experimental data. Author (TAB)

N69-30044# Commissariat à l'Energie Atomique, Chuscian (France). Centre de Production de Plutonium.

INSTALLATION OF A BITUMEN COATING PLANT FOR HIGH ACTIVITY CONCENTRATES [INSTALLATION PILOTE D'ENROBAGE PAR LE BITUME DE CONCENTRATS DE HAUTE ACTIVITE]

Jean Rodier, Guy Lefillatre, and Philippe Seyfried Apr. 1969 25 p refs In FRENCH; ENGLISH summary

(CEA-R-3734) Avail: CFSTI

Following the excellent results obtained on the industrial coating of radioactive sludges, the possibility of also solidifying the evaporation concentrates with bitumen has been considered. For high activity concentrates, the use of bitumen is however limited by the two main parameters, temperature resistance and irradiation resistance. By making use of the characteristics of a blown bitumen, it has been possible to design a high activity coating pilot plant treating concentrations of several tens of curies per litre. This plant will make use of a screw-type extrusion machine capable of coating treated concentrates at a rate of 20 l/hr. Before being coated, the concentrates will be subjected to a coprecipitation treatment designed to make the radioelements insoluble. This installation will make possible, apart from technological studies, laboratory experiments on the coated material (measurements on self-heating, on electrical charges, on radiolytic gases, and also lixiviation tests. It is considered that it will be possible to coat concentrates having an activity of 20 Ci/l at a price of 1,940 F per cubic metre. Author (ESRO)

N69-30065*# National Aeronautics and Space Administration, Washington, D.C.

EFFECT OF IMPREGNATION ON THE MECHANICAL PROPERTIES OF GLASS FIBERS [INFLUENCE DES IMPREGNATIONS SUR LES PROPRIETES MECANIQUES DE FILS DE VERRE]

A. Kh. Iablokoff Jul. 1969 50 p refs Transl. into ENGLISH from French Report ONERA-NT-65

(NASA-TT-F-12273; ONERA-NT-65) Avail: CFSTI CSCL 11E

The effect of the impregnation of glass fibers prior to weaving are studied. It is established that the strength of composite glass fibers can be increased substantially by impregnation with latex or synthetic resins; these impregnations permit the build-up of interfibrillar bonds and the formation of sheaths. Mixed fibers (glass-resin) obtained under these conditions exhibit tensile strengths about four times greater than that ordinarily observed. The essential factors that govern these treatments are: wettability, viscosity, and elasticity, particularly the relative elastic elongation of the impregnating resins. Author

N69-30201# Technical Univ. of Denmark, Lyngby. Building Materials Lab.

EFFECT OF AGGREGATE GRADING AND C/S RATIO ON SHRINKAGE OF AUTOCLAVED CALCIUM SILICATE PRODUCTS

Fariborz Radjy, Cedric W. Richards, Torben C. Hansen Jan. 1969 25 p refs

(TR-4) Avail: CFSTI

A theory is developed which relates drying shrinkage of autoclaved calcium silicate products to the specific surface of the siliceous aggregate and the CaO/SiO_2 ratio. There is reasonable agreement between experimental and theoretical results. Author

N69-30229# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

APPLICATION OF INFRARED SPECTROSCOPY FOR THE DETERMINATION OF STRUCTURAL CHANGES AT ION-EXCHANGE HARDENING OF GLASSES

K. K. Evstropev et al Jul. 1968 6 p refs Transl. into ENGLISH from Zh. Prikl. Spektroskopii (USSR), v. 6, no. 5, 1967 p 880–881
(AD-685137; FTD-HT-23-276-68) Avail: CFSTI CSCL 11/2

To check on the ion exchange method of glass strengthening, the authors treated samples of sodium-aluminum-silicate glasses to which TiO2 was added. The ion exchange was produced in a salt bath containing 95 wt.% Li2SO4 and 5 wt.% Na2SO4. Treatment of the glass for several minutes at 830-900C resulted in an increase in strength by 8-10 times, owing to the crystallization of beta-eucryptite which has a negative coefficient of thermal expansion on the surface. The thickness of this pyroceramic layer was determined by infrared spectroscopy, based on the fact that the spectrum of light reflected from the surface differs from the spectrum of the untreated glass inside the sample. The thickness increases with the treatment time from 50-55 microns at three minutes to 90-110 microns. The depth of the ion-exchange layer increases in proportion to the square root of the treatment time, thus showing that the ion exchange is governed by diffusion processes. The infrared spectroscopy results agreed with measurements made with a microscope. Author (TAB)

N69-30258# Norges Tekniske Hoegskole, Trondheim. Norges Brannteknisk Laboratorium.
ADVANCES IN SOME TEST METHODS FOR THE COMBUSTIBILITY CLASSIFICATION OF PLASTIC PRODUCTS. [FREMSKAFFELSE AV EGNEDE PROVNINGSMETODER FOR BRANNTEKNISK KLASSIFISERING AV PLASTPRODUKTER]
Wilhelm Gundersen 1967 104 p refs in NORWEGIAN
(Rept-4) Avail: CFSTI

The methods described are applicable for testing the flammability of structural materials. The following methods were used: (1) the welding method for determining flammability (corner tests, rod tests), tensile strength, drop formation, and toxicity; (2) the ASTM method for determining flammability (D 635 or 668-56 T through D 1692-59 T); and (3) special methods for determining such basic properties as flash point, heat of combustion, thermogravimetric analysis, and differential thermal analysis. Reproducibility of the methods was tested on 19 different plastic materials covering plastic foams, dense plastics, and glass-fiber plastics. In addition to reproducibility, the methods were evaluated for their value in testing other structural materials. Transl. by K.W.

N69-30328# Electrotechnical Lab., Tokyo (Japan).
STUDY ON DRILLING OF PLASTICS
Tameyasu Tsukada and Susumu Shiratori Aug. 1968 136 p In JAPANESE; ENGLISH summary
(REPT-687) Avail: CFSTI

A study was undertaken to define optimum drilling conditions for plastics. A survey was first made of the thermoplastics and thermosets used in industrial applications. The experimental method and equipment used in this study are then described. Two different systems of apparatus, such as constant load and constant speed feed of the drill, were developed. A drill dynamometer was designed to measure and record the drilling forces of thrust and torque. To elucidate the problems of cracking and gumming, a high speed camera and a camera fitted with a microscopic lens were used to photograph the drilling phenomena. Fourteen differently sized and angled drills were used in this experiment and the effect of the angle and the dimensional accuracy on the drilling phenomena was observed. Twenty-two kinds of plastic materials were chosen to be studied. The actual drilling experiments are then summarized. The optimum conditions for drilling plastics were subsequently established. Observations of the quality of the drilled holes were made, and it was found to be possible to divide plastics by gumming and burning characteristics caused by heating, or by cracking due to brittleness. B.P.

N69-30342# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
POLYPYROMELLITIMIDE FIBERS: THEIR OBTAINMENT AND THEIR PHYSICAL AND MECHANICAL PROPERTIES
A. P. Rudakov et al 30 Jul. 1968 11 p refs Transl. into ENGLISH from Khim. Volokna (Leningrad), no. 5, 1966 p 20–23
(AD-685145; FTD-HT-23-371-68) Avail: CFSTI CSCL 11/5

The possibility of obtaining fibers from polypyromellitimide has been studied. It was found that heat-resistant high-modulus, nonshrinking fibers could be obtained under laboratory conditions from polypyromellitimide. Their physical and mechanical properties are found to be considerably better than those of mass-produced heat-resistant fibers. Polypyromellitimide fibers apparently can be used to produce high-temperature cord and textiles, and also filler for plastic materials and textolites. Author (TAB)

N69-30363# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHOD OF DETERMINING THE PERFORMANCE OF LUBRICANTS WITH ADDITIVES USING THE IKM-1 MACHINE WITH A FOUR-CYCLE AIR-COOLED CARBURETOR ENGINE
V. F. Filippov et al 4 Dec. 1968 34 p refs Transl. into ENGLISH from Tr. Vses. Nauchn.-Issled. Inst. po Pererabotke Nefti (Moscow), no. 10, 1967 p 266–289
(AD-685020; FTD-MT-24-299-68) Avail: CFSTI CSCL 11/8

The proposed method for determining the performance of additive oils on the special one cylinder IKM-1 engine unit with a 4-cycle air-cooled carburetor makes it possible to evaluate base oils in relation to their chemical composition, original raw material, and technological processing; to determine the functional properties of individual additives; and, to select optimum combinations of additives to obtain the desired type of oils. TAB

N69-30388# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
POLYMERIZED PHOSPHATES
F. M. Perelman 30 Jul. 1968 6 p Transl. into ENGLISH from Priroda (Moscow), no. 7, 1967 p 68–69
(AD-685062; FTD-HT-23-423-68) Avail: CFSTI CSCL 11/4

An inorganic polyphosphate binder for fiberglass was developed. The binder was composed of a mixture of potassium and sodium polyphosphates in a determined ratio (not given). Heat-insulating materials made of ultra-thin fiberglass with the new binder exhibited high heat resistance adequate mechanical strength, and low density. In addition, they are resistant to combined thermal and vibrational loads. Author (TAB)

N69-30396# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DISCOLORING AND BREAKDOWN OF BARIUM TITANATE
N. I. Shefer et al Dec. 1968 11 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Fiz. (Tomsk), v. 10, no. 8, 1967 p 60–64
(AD-685022; FTD-HT-23-1013-68) Avail: CFSTI CSCL 20/2

A study is made of the phenomenon of spontaneous increase of current in powerful fields in barium titanate. Its connection with the movement of color centers is established. The injection of electrons leads to an increase of the number of f-centers, which weakens the electric strength of the specimen. Author (TAB)

19 MATHEMATICS

Includes calculation methods and theory; and numerical analysis. For applications see: 08 Computers.

N69-29013# Washington Univ., St. Louis, Mo. Dept. of Mechanical and Aerospace Engineering Systems.

OPTIMAL CONTROL OF NONLINEAR SYSTEMS WITH INPUT CONSTRAINTS

Mohammed Azadul Alam (Ph.D. Thesis) Jun. 1968 84 p refs
(Grant AF-AFOSR-1422-68)
(AD-684543; AFOSR-69-0722TR) Avail: CFSTI CSCL 12/1

A new method of optimal control of nonlinear systems discussed in this dissertation. The system is optimized by minimizing a quadratic performance index, while the input is subjected to a constraint. This problem is considered as a nonlinear programming problem and some theorems of nonlinear programming are used to derive the necessary and sufficient conditions for optimal control. These conditions are then simplified to an integral equation which, for nonlinear systems, is nonlinear and is a necessary condition only. The existence of a solution of this integral equation is studied. Two different methods of solving it namely, successive approximation method and functional Lagrange expansion method are discussed. Finally a numerical example is worked out in detail.
Author (TAB)

N69-29016# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.

CORRELATION BETWEEN TWO VECTOR VARIABLES

A. M. Kshirsagar 4 Mar. 1969 19 p refs
(Contract N00014-68-A-0515)
(AD-684428; TR-26) Avail: CFSTI CSCL 12/1

H. Ruben (1966) has suggested a simple approximate normalization for the correlation coefficient in normal samples, by representing it as the ratio of a linear combination of a standard normal variable and a chi variable to an independent chi variable and then using Fishers approximation to a chi variable. This result is extended in this paper to a matrix, which in a sense is the correlation coefficient between two vector variables x and y. The result is then used to obtain large sample null and non-null (but in the linear case) distributions of the Hotelling-Lawley criterion and the Pillai criterion in multivariate analysis. Williams (1955) and Bartlett (1951) have derived some exact tests for the goodness of fit of a single hypothetical function to bring out adequately the entire relationship between two vectors x and y, by factorizing Wilks lambda suitably. These factors are known as direction and collinearity factors, as they refer to the direction and collinearity aspects of the null hypothesis. In this paper, the other two criteria viz. the Hotelling-Lawley and Pillai criteria are partitioned into direction and collinearity parts and large sample tests corresponding to them are derived for testing the goodness of fit of an assigned function.
Author (TAB)

N69-29035# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

BINARY ANALYSIS. PART 1: DEFINITIONS AND TREATMENT OF BINARY FUNCTIONS

Rene-Louis Vallee Dec. 1968 52 p
(CEA-R-3534-1-E-Pt-1) Avail: AEC Depository Libraries

The study of binary groups under their mathematical aspects constitutes the matter of binary analysis, the purpose of which consists in developing altogether simple, rigorous, and practical methods needed by the technicians, the engineers, and all those who may be mainly concerned by digital processing. This subject which tends to play a main part in nuclear electronics as well as in several other research areas is discussed.
Author (NSA)

N69-29048# Illinois Univ., Urbana. Dept. of Computer Science.

ON THE USE OF FINITE FIELD BASED MODELING IN POLYNOMIAL MANIPULATION

Stephen J. Nuspl (Ph.D. Thesis) Jun. 1968 111 p refs
(Grant NSF GP-4636)
(PB-182800) Avail: CFSTI CSCL 12A

A class of polynomical redundancies was sought in several variables over the integral domain of integers which would enhance the power of polynomial manipulators and increase their efficient handling of more complex problems than are currently possible. The finite field based modeling functions of (3.6.07) and (4.2.06) were shown capable of doing both. The most illustrative example presented is the application of the augmented modeling method to the determination of the greatest common divisor of two polynomials. It is shown that the method can be used to increase the speed of determining whether two polynomials are relatively prime by possibly orders of magnitude.
Author (USGRDR)

N69-29051 Northwestern Univ., Evanston, Ill.

LINEAR DECISION FUNCTIONS FOR PATTERN RECOGNITION

Te-Tung Lin (Ph.D. Thesis) 1968 65 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 69-1883

Linear decision functions approximating the optimal decision functions in the least-mean-square error sense are determined. This approach is studied for both two-category and multi-category problems. It is shown that for the performance criterion of minimum error probability, this method gives a result for the multi-category case essentially identical to that obtained by Chaplin and Levedi's method and provides the result in a simpler and explicit form. It is found that linear decision functions can be improved by approximating the optimal decision functions more closely in the critical region. An iterative algorithm for improving the linear decision function is given. Several examples are given to illustrate how the algorithm could reduce the error appreciably.
Dissert. Abstr.

N69-29091# Minnesota Univ., Minneapolis. Dept. of Aeronautics and Engineering Mechanics.

A STUDY OF WEAKLY NONLINEAR DYNAMICAL SYSTEMS AND THEIR STABILITY Final Report, 16 Sep. 1967–15 Sep. 1968

P. R. Sethna Sep. 1968 4 p refs
(Grant AF-AFOSR-66-0704A)
(AD-684649; AFOSR-69-0654TR) Avail: CFSTI CSCL 12/1

A systematic procedure for obtaining the Liapunov functions necessary for obtaining the largest domain of attraction of almost periodic solutions of a class of weakly nonlinear dynamical systems has been completed. The procedure has then been applied to obtain explicit estimates of domains of attraction for systems of physical importance. Furthermore, some previously obtained mathematical results on systems with fast and slow time have now been applied to a large class of parametrically excited dynamical systems that occur in technical applications. The frequency of the parametric excitations in this work can range from very low to very high frequencies.
Author (TAB)

N69-29106# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia). Div. of Mathematical Statistics.

A NOTE ON A PROBLEM POSED BY FISHER

A. W. Davis 1969 7 p refs
(PB-182666) Avail: CFSTI CSCL 12A

Fisher's asymptotic expansion of the mean of the fiducial distribution of the binomial parameter is shown to be somewhat identical with the expansion of a Bayesian mean, as apparently conjectured by Fisher.
Author (USGRDR)

N69-29118 Pennsylvania Univ., Philadelphia.
COMPUTER TECHNIQUES FOR THE DETERMINATION OF TRANSFER FUNCTIONS
David Louis Fletcher (Ph.D. Thesis) 1968 106 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-95

This dissertation extends the transfer function synthesis procedure to the case of generalized input to the system to be determined. First a technique is developed that utilizes M samples of the output of the system where M ≥ 2K, with K being the assumed order of the wave form of the output of the system. A sensitivity matrix called the condition matrix is developed that gives the sensitivity of the transfer functions developed relative to small changes in the coefficients of the characteristic equation of the system. The synthesis procedure works for both aperiodic and periodic input and output functions. These functions can be analytic or known only at discrete points from measurements of the input-output data. Dissert. Abstr.

N69-29141*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
A FORMALIZATION OF MEASUREMENT SCALE FORMS
Wayne A. Lea Washington Jun. 1969 44 p refs
(NASA-TN-D-5277) Avail: CFSTI CSCL 12A

A mathematical model of measurement and specific scale forms is developed, using the minimum mathematical structure necessary to define each scale type. Measurement is defined, and a series of restrictions are applied to measurements to yield a precisely specified hierarchy of measurement scale forms including nominal, ordinal, interval, and ratio scales, as well as several others. Equivalences are mathematically defined for each scale form, and theorems are presented specifying the sets of transformations under which equivalence is preserved, thus yielding the scale form invariances. The hierarchy of measurement scale forms is summarized in a pictorial 'spectrum' diagram. Author

N69-29145# Washington Univ., St. Louis, Mo. Dept. of Systems Mechanical and Aerospace Engineering.
PURSUIT-EVASION DIFFERENTIAL GAMES
John B. Berger (Ph.D. Thesis) Jan. 1968 123 p refs
(Grant AF-AFOSR-1422-68)
(AD-684542; AFOSR-69-0611TR) Avail: CFSTI CSCL 15/7

Differential game theory is applied to several classes of pursuit-evasion problems. For these differential games the dynamics of the participants are described by linear nonstationary differential equations. One class of differential games that was formulated and studied is the differential game, where the evader has to out maneuver a pursuer, if it is to strike the target that the pursuer is defending. This differential game will be called the differential endgame. The differential endgames payoff functional is the square of the terminal engagement miss distance weighted against the difference of the participants control energies, spent during their respective flight times. The evaders target constraints are the position coordinates of the target and the evaders kinetic energy as it strikes the target. Author (TAB)

N69-29148# RAND Corp., Santa Monica, Calif.
A NONINTERPOLATION THEOREM ABOUT PI SUB ONE, SUPERSCRIPT ZERO UNDECIDABLE SENTENCES OF ARITHMETIC
Robert A. Dipaola Mar. 1969 24 p refs
(Contract F44620-67-C-0045)
(AD-684698; RM-5875-PR) Avail: CFSTI CSCL 12/1

Given the fact that the partial ordering induced by the implication relation on equivalence classes of undecidable (not mechanically derivable) sentences of formal systems of arithmetic is dense, the ordering is investigated with respect to undecidable sentences which are substitution instances of the same formula. It is shown that if S is a recursively enumerable set having n specified members in its complement, n greater than or equal to 2, then one can effectively find a formula F which represents S in T such that not-F is undecidable on the complement of S, and the n substitution instances of not-F arising from the n specified members of the complement of S constitute an initial segment of length n. Author (TAB)

N69-29225# Southern Methodist Univ., Dallas, Tex. Dept. of Statistics.
APPROXIMATIONS TO LARGE PROBABILITIES OF ALL SUCCESSES FOR GENERAL CASE AND SOME OPERATIONS RESEARCH IMPLICATIONS
John E. Walsh and G. J. Kelleher 20 Feb. 1969 10 p ref
(Contract N00014-68-A-0515)
(AD-684427; TR-25) Avail: CFSTI CSCL 12/2

There are many cases where an overall effort is successful if and only if the efforts (or events) of a sequence are all successful. Often, the principal interest is in cases where overall success has a large probability (say, at least .8). Suppose there are n efforts in the sequence and that p sub i (s sub (i-1)) is the probability that the i-th effort is a success given that preceding efforts 1, ..., i-1 are successes (i = 1, ..., n) where s sub o denotes no conditions. An approximate value, also sharp upper and lower bounds, are developed for the probability that all n events are successes. This is done for various levels of generality, including a form of complete generality. These results depend only on n, the generality level, and the arithmetic average of the p sub i (s sub (i-1)). They are useful when the probability of all successes is at least .8; then the approximate value is near both bounds. The necessity of only considering the arithmetic average of the p sub i (s sub (i-1)), rather than their product, sometimes can be useful in analyses of an operations research nature (including reliability situations). Author (TAB)

N69-29253 Texas Univ., Austin.
COMPACT CONVEX SETS AND CONTINUOUS AFFINE FUNCTIONS
Jonnie Bee Bednar (Ph.D. Thesis) 1968 86 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-16050

A generalization to the class of all compact convex subsets of a locally convex Hausdorff topological vector space of the concepts of quotients and product of topological spaces is obtained. The set of all positive normalized inner and outer regular Borel measures on a compact Hausdorff space serve as the model for the quotient or product of a collection of compact convex sets. The resulting definitions of convex quotients and convex products and the properties derived are then used to obtain some information about complemented subspaces of the space of continuous affine functions on a compact convex subset of locally convex Hausdorff topological vector space. The existence of projections of norm one on such spaces is also investigated. Specific results include sufficient conditions for the existence of a projection of norm one on what are called subspaces with weakly separating quotients in the text. Dissert. Abstr.

N69-29256 Stanford Univ., Calif.
ADAPTIVE LINEAR DISCRETE-TIME ESTIMATION
Kenneth David Senne (Ph.D. Thesis) 1968 86 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-287

A comprehensive analysis demonstrates the convergence characteristics of two continually adapting, finite-dimensional, discrete-time linear estimators. Based on the single assumption that independent data samples are received from a Gaussian process, global analytic formulas are derived which illustrate the time behavior of the moments of the estimates provided by two nonlinear, stochastic gradient-descent algorithms. The resulting recursion relations are valid for a variety of strategies relating to gradient step size. The particular case of an algorithm using constant step size is solved in detail, allowing for the explicit evaluation of steady-state mean-squared errors, rates of convergence, and necessary and sufficient conditions for convergence of the algorithm. Dissert. Abstr.

N69-29262*# Techtran Corp., Glen Burnie, Md.
THE LOGARITHMICALLY NORMAL LAW OF DISTRIBUTION OF DIMENSIONS OF PARTICLES WHEN BROKEN INTO SMALL PARTS [UBER DAS LOGARITHMISCH NORMALE VERTEILUNGSGESETZ DER DIMENSIONEN DER TEILCHEN BEI ZERSTUCKELUNG]
A. N. Kolmogoroff Washington NASA Jun. 1969 6 p refs Transl. into ENGLISH from Compt. Rend. (Dokl.) Acad. Sci. URSS, v. 31, no. 2, 1941 p 99–101
(Contract NASw-1695)
(NASA-TT-F-12287) Avail: CFSTI CSCL 12A

A general diagram of the chance process of gradual fragmentation is presented. The Gauss law of distribution can be theoretically derived for logarithms of the dimensions of particles in the limiting value. It would be interesting to investigate the mathematical schemes according to the rate at which fragmentation of particles decrease (or increase) with reduction in dimension. Author

N69-29268*# Arizona Univ., Tucson.
THE DESIGN OF LINEAR MULTIVARIABLE CONTROL SYSTEMS USING MODERN CONTROL THEORY (WITH APPLICATIONS TO COUPLED CORE REACTOR CONTROL)
Charles R. Slivinsky, Donald G. Schultz, and Lynn E. Weaver Washington NASA Jun. 1969 184 p refs
(Grant NGL-03-002-006)
(NASA-CR-1345) Avail: CFSTI CSCL 12A

Both conventional, frequency-domain techniques and modern, combined frequency-domain, time-domain procedures are considered. Two basic design requirements are noninteraction and that specified subsystem transfer functions be achieved. Conventional methods are shown to have the disadvantage of complexity, both in carrying out the design calculations and in the physical implementation of the compensation. The attention centers on the state variable feedback design of multivariable systems, including procedures for identifying the fixed zeroes of the subsystems and the number of subsystem poles controlled by state variable feedback. By treating each subsystem individually, previously developed knowledge of state variable feedback design of single-input, single-output systems can be applied. Three methods for adding dynamics to the multivariable system before state variable feedback is applied are proposed for improving the system response. A coupled-core nuclear reactor with a three-core linear model is examined as an example of the application of state variable feedback design. K. W.

N69-29291 City Univ. of New York
IDEALS OF OPERATORS
Peter Falley (Ph.D. Thesis) 1968 59 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-15930

It may be observed that in the space of B(E,F) of bounded operators from the Banach space E into the Banach space F certain well-known ideals can always be defined. Each of these ideals may be described as the precise class of operators from E into F which map the unit ball of E into a prescribed saturated class of bounded sets in F. Also, each of these ideals may be viewed as a left exact functor of two variables from the category Banach spaces into the category of complex linear spaces, contravariant in the first, and covariant in the second variable. These properties may be used to define the concept of a universal ideal, a procedure (functor) which associates a definite ideal $U(E,F)$ of operators from E into F, called a realization of U. It is shown that every two-sided ideal of completly continuous operators on a Hilbert space is a realization of a universal idea. Dissert. Abstr.

N69-29292 Polytechnic Inst. of Brooklyn, N. Y.
GENERALIZATIONS OF PERFECT MEASURES
Eric Philip Goldwasser (Ph.D. Thesis) 1968 65 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 68-16244

The set of all countably additive measures on an arbitrary measurable space are examined. Considered is the subset of perfect measures and some properties of this set including a condition such that all measures are perfect. Introduced are several topologies onto the set of all countably additive measures and examined are some topological properties of the subsets of perfect and compact measures. The notion of perfect measure by defining perfect complex measure and perfect vector valued measure is generalized. Defined is a more general notion of a measure being perfect relative to a measurable space other than the real line with the Borel σ-algebra. Many of the results for real nonnegative measures are shown to be true for perfect complex and vector valued measures given measurable space. Measures on a σ-algebra of subsets of a group and the relationship between perfect measure and invariant measure are investigated. Dissert. Abstr.

N69-29311# California Univ., Los Angeles. Dept. of Mathematics.
UNIFORMLY BOUNDED COSINE FUNCTIONS IN HILBERT SPACE
H. O. Fattorini [1969] 33 p refs
(Contract Nonr-233(76))
(AD-685401) Avail: CFSTI CSCL 12/1

Contents: Banach limits and integrals. The non-measurable case; The measurable case: The almost periodic case: Some applications to operational differential equations. TAB

N69-29327 Stanford Univ., Calif.
THE DESIGN AND SYNTHESIS OF LINEAR MULTIVARIABLE SYSTEMS WITH APPLICATION TO STATE ESTIMATION
Robert Allan Singer (Ph.D. Thesis) 1968 230 p
Avail: Univ. Microfilms: HC $10.35/Microfilm $3.00 Order No. 69-294

The theme is the analysis, design, and synthesis of multivariable linear systems with a particular view toward applications in state estimation. A canonicalization procedure that provides a rationale for the design and analysis of constant linear multivariable systems is developed. In general, the canonicalization of multivariable systems requires transformations of the inputs and outputs as well as transformation of the system state vector. Such a procedure is used to decompose multivariable systems into cascaded configurations of scalar output and scalar input subsystems and to obtain system representations from which a variety of observers and controllers can be simply determined. When the system matrix is cyclic and the system is both observable and controllable, the complexity of observers and controllers can often be reduced by applying appropriate output and input transformations. Dissert. Abstr.

N69-29328 Northwestern Univ., Evanston, Ill.
THE REALIZATION OF AN ARBITRARY SWITCHING FUNCTION AS AN INTERCONNECTION OF THRESHOLD ELEMENTS
Daniel Lawrence Ostapko (Ph.D. Thesis) 1968 97 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 69-1905

A class of switching functions, called threshold-product functions is defined and studied in detail. It is shown that every threshold-product function can be expressed as the logical product of a parity function and a threshold function. An economical threshold-logic realization for a threshold-product function is obtained from a constrained solution. A systematic technique for finding a constrained solution for a threshold-product function is given. This technique can also be employed for testing whether a switching function is a threshold-product function. A minimum realization for certain threshold-product functions is obtained. The problem of realizing an arbitrary switching function by an interconnection of threshold and parity elements is also considered. Using several criteria, it is shown that parity functions and threshold functions are opposites. Dissert. Abstr.

N69-29330 Stanford Univ., Calif.
PERFORMANCE-ADAPTIVE RENEWAL POLICIES FOR THE OPERATION OF LINEAR SYSTEMS SUBJECT TO FAILURE
Robert Stephan Ratner (Ph.D. Thesis) 1968 91 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 69-274

A solution is presented to the problem of determining the optimal use of available renewal capability for first-order time-varying linear systems with a quadratic performance index, using a probabilistic model of component failure. The renewal policy determined is performance-adaptive in the sense that it depends on the system failure and renewal histories and their relation to future operating requirements. This adaptivity permits graceful degradation of a system operating with a series of component failures. The renewal policy is determined with respect to other control variables to insure overall optimal performance. The procedure is extended quasi-optimally to linear systems of arbitrary order. The optimal control and renewal policies are specified by a set of Riccati equations whose solutions are precomputed. The optimal renewal function has a simple representation as a set of points of optimal renewal and of intervals where immediate renewal in the event of failure is the optimal course of action. Dissert. Abstr.

N69-29349 Lehigh Univ., Bethlehem, Pa.
LINEAR TRANSFORMATIONS ON FUNCTION SPACES
Joseph Jay DuBois (Ph.D. Thesis) 1968 93 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 68-15897

Linear transformations on the function space, B(X), of locally bounded complex valued Baire functions on the locally compact and sigma-compact space, X, are studied with the aim of generalizing known results for matrix transformations: i.e., in the case that X is the natural numbers. The notion of a uniform method is investigated and an equivalent definition is given. The collection of conservative uniform methods is shown to form a Banach algebra in which the left topological zero divisors are characterized, generalizing the Tauberian Theorem of Berg for matrix methods. As an algebra the set of conservative uniform methods is shown to be semisimple. The set in this algebra which consists of all methods which contain a particular bounded function in their convergence domain is shown to be closed left ideal. Dissert. Abstr.

N69-29385 University of Southern Calif., Los Angeles.
OPTIMAL INPUT FOR INFORMATION MAXIMIZATION IN LEAST-SQUARE PARAMETER ESTIMATION
David Edward Wallis, Jr. (Ph.D. Thesis) 1968 82 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 69-654

Let a dynamic system $\dot{x} = f[x, u(t), t, a]$ contain a random parameter a whose statistics are known, and let the system output y be observed on [0, T] as the function $y(t) = g[x(t), u(t), t, a] + v(t)$, where v is zero-mean white gaussian noise. The problem is to choose an optimal input, or control, u_{opt} from a class U of admissible controls such that when y is processed by an optimal estimator to give an estimate $\hat{a}$ of a, the joint minimum of the expected square estimation error (ESEE) is achieved. Since both an optimal control and an optimal estimator operating on y are involved in this joint optimization problem, a general and effective method for determining u_{opt} has not thus far been developed. The present work introduces a philosophy of information maximization which enables the determination of u_{opt} to be divorced from the determination of the optimal estimator. Dissert. Abstr.

N69-29386 Polytechnic Inst. of Brooklyn, N.Y.
AN ANALYTIC APPROACH TO THE STARTUP AND SHUTDOWN OF PROCESSES
Arthur Royal Peck (Ph.D. Thesis) 1968 163 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 68-16273

An analytical approach is presented to the startup and shutdown of processes. The approach employs the basic concepts of graph theory, symbolic logic, automata theory, and game theory. The example chosen, a fluid catalytic cracking (FCC) unit, is developed first as a finite automaton, then as a discrete decision process, and finally as a Markov process. The startup and shutdown sequences are cast into a restricted grammar which defines both states and operations without the ambiguity and redundancy usually found in operation manuals. A state diagram for the FCC unit is constructed and the feasibility of the startup policy is analyzed. Feasibility is tested via the matrices of the underlying graph of the state diagram of the process. No exit and no entry conditions as well as endless loops are located. The necessity for additional equipment or greater reliability in any region of the process is evaluated. Dissert. Abstr.

N69-29393 Illinois Univ., Urbana.
NUMERICAL ANALYSIS OF AXI-SYMMETRIC WAVE PROPAGATION IN ELASTIC-PLASTIC LAYERED MEDIA
Ahmed Hamdy Mohamed Sameh (Ph.D. Thesis) 1968 107 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-1434

A numerical technique is developed for the prediction of free field ground motions in a layered elastic-plastic half-space. Although the theory of wave propagation in layered media is well established, analytic solutions of significant problems are possible only for linearly elastic cases. A mathematically consistent discrete model developed by Ang is used in this study to simulate the half-space. In essence, the underlying continuum is discretized into a finite number of discrete points consisting of mass points, at which displacements, velocities, and accelerations are defined, and stress points, at which the stress and strain tensors are defined. The equations of motion and the strain-displacement relations can be derived directly from the model which can be shown to be central finite difference analogues of the corresponding continuum equations. Dissert. Abstr.

N69-29397 Clarkson Coll. of Technology, Potsdam, N.Y.
MULTIVARIABLE FEEDFORWARD-FEEDBACK PROCESS CONTROL
Gaylord Grover Greenfield (Ph.D. Thesis) 1968 449 p
Avail: Univ. Microfilms: HC $20.25/Microfilm $5.75 Order No. 68-17958

The structural aspects of information flow in linear multivariable systems and the information content of various system model structures are discussed. These two concepts provide a common basis for several alternative approaches to the linear analysis of multivariable feedforward-feedback regulator control for chemical

process systems. The main complicating factor of this multivariable regulator control problem, as compared with the corresponding single-variable problem, is intercoupling between controlled variables. The alternatives developed differ in their description and control treatment of these intercouplings. Two of the methods (the V*-form and the structural uncoupling methods) introduce direct control action to eliminate the effects of intercoupling. One of these uncoupling methods (the V*-form method) requires only dynamical information available from process transfer matrices. The other method (the structural method) obtains additional advantages by using more detailed dynamical information available from a differential equation model of the process. Dissert. Abstr.

N69-29410 Stanford Univ., Calif.
A METHOD FOR COMPUTING PROBABILITIES IN COMPLEX SITUATIONS
William Frederick Rousseau (Ph.D. Thesis) 1968 158 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-282

A solution is presented to the problem of describing conveniently and precisely complex probabilistic relationships between events. While the use of a large probability space of joint events is a theoretical solution, it is often useless in practical problems because it is too far removed from the model builder's understanding of the problem. Furthermore, in reasonably large problems, such as medical diagnosis, the joint probability space is so large that storing the probabilities of joint events or working with them is impossible. The method developed is a combination of probability and Boolean algebra. Both graphical and algebraic notations are presented. The method allows models to be constructed using the notion of cause and effect. Cause and effect is not the only interpretation; a physical analog and a mathematical approach based on probability and Boolean algebra are presented as alternatives. Dissert. Abstr.

N69-29417*# Southern Illinois Univ., Carbondale. School of Technology.
STRUCTURAL DESIGN CONCEPTS FOR FUTURE SPACE MISSIONS
Julian H. Lauchner, R. Buckminster Fuller, Joseph D. Clinton, Mark B. Mabee, Richard M. Moeller et al 1 Nov. 1968 63 p
(Grant NGR-14-008-002)
(NASA-CR-101577) Avail: CFSTI CSCL 12A

This report explains one method of subdividing a polyhedron into triangular facets and exploding it into the surface of a sphere. A mathematical model is included which explains the geometry used in subdividing and transforming the icosahedron into the structural sphere. Also included are a computer program and a plot routine used in the computations. Author

N69-29424# Carnegie-Mellon Univ., Pittsburgh, Pa. Management Sciences Research Group
A SOLUTION PROCEDURE FOR A MODIFIED P-MODEL WITH SPECIAL REFERENCE TO MIXED-INTEGER PROGRAMMING
R. Jagannathan Dec. 1968 21 p refs
(Contract Nonr-760(24))
(AD-684078; MSR-148) Avail: CFSTI CSCL 12/2

Charnes and Cooper distinguish three types of models: E model, V model and P-model of a chance-constrained programming, classified on the basis of the criterion function used. In this paper a modified P-model is formulated and it is shown how an approximate solution of such a problem can be obtained by solving a parametric convex quadratic programming problem. A mixed-integer programming problem is formulated as a modified P-model and the results are used in devising a solution procedure for any mixed-integer programming. TAB

N69-29433 Rice Univ., Houston, Tex.
A FACTORIZATION PROCEDURE FOR THE SOLUTION OF ELLIPTIC DIFFERENCE EQUATIONS
Todd Dupont (Ph.D. Thesis) 1968 52 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-15614

The systems of linear equations which arise from the discretization of elliptic boundary value problems are usually so large that they are much more efficiently solved by iterative methods rather than direct methods. This is an analysis of a new iterative method for solving these systems of elliptic difference equations. Dissert. Abstr.

N69-29438 University of Southern Calif., Los Angeles.
OPTIMAL CONTROL PROBLEMS WITH RETARDATIONS AND RESTRICTED PHASE COORDINATES
Sheng-Chao Huang (Ph.D. Thesis) 1968 77 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 69-619

Necessary conditions are studied for an optimal control problem with or without restricted phase coordinates. The systems are specified by differential-difference equations with their allowed right hand sides being a quasi-convex family. The multiplier rule developed by Neustadt is used and maximum principles in integral form as well as in pointwise form are obtained. Dissert. Abstr.

N69-29462 Cornell Univ., Ithaca, N.Y.
OPTIMAL AND EFFICIENT DESIGNS OF EXPERIMENTS
Corwin Lee Atwood (Ph.D. Thesis) 1968 80 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 68-15705

Let f be the k-vector of continuous linearly independent regression functions on a compact space $\mathcal{X}$, θ the k-vector of unknown parameters, and $f^{(1)}$ and $\theta^{(1)}$ the vectors consisting of their first s components. If $\mathcal{X}$ is q-dimensional and satisfies certain symmetries and if the functions $f_i(x)$ are of low enough degree in each variable then any D- or G-optimal design for estimating θ is supported only on certain points of symmetry. Three such theorems are given explicitly. Dissert. Abstr.

N69-29464 Texas Univ., Austin.
A NEW SOLUTION TO MATHIEU'S EQUATION WITH APPLICATION TO HILL'S EQUATION
James Key Beard (Ph.D. Thesis) 1968 204 p
Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 68-16049

Mathieu's equation results from boundary value problems involving separation of variables in Laplace's equation in elliptic (confocal) coordinates, in the analysis of certain mass spectrometers, and in fluid flow and structural studies. A novel approach to the problem of calculation of eigenvalues of the parameters for periodic solutions, and of the characteristic exponent for given fixed parameters, is presented and demonstrated. The approach given yields expansions in several variables, and several variations are presented. The facility of the approach is demonstrated by presentation of computed results from three expansions. The approach presented also is applicable to Hill's equation and to higher order linear differential equations with periodic coefficients. Extensive use is made of continued fractions in calculation of functions given by Taylor series. This theory and other examples of its application are given and explained in some detail. Dissert. Abstr.

N69-29470# System Development Corp., Santa Monica, Calif.
PERFECT DOUBLE HAMMING-ERROR-CORRECTING CODES ON Q-SYMBOLS
Ronald Alter Mar. 1969 13 p refs
(AD-685438; SDC-SP-3284) Avail: Issuing Activity CSCL 9/4

All previously published results in this area are stated. This includes the cases Q = 2, 3, 4, 5, and 6 and the authors results for the case Q = 7. The theorem, that for any Q there exist at most a finite number of perfect double Hamming-error-correcting codes on Q-symbols, is proven. The authors method, the use of continued fractions for solving Diophantine equations, is generalized and extended so that results for larger values of Q are in fact attained. In addition, the difficulties which arise in applying this method for all values of Q are discussed. Author (TAB)

N69-29472# Information Research Associates, Inc., Waltham, Mass.
RESEARCH ON THE WIENER CANONICAL EXPANSION OF BAYES' OPTIMUM FILTERS Final Report, 1 May 1967–31 Dec. 1968
Donald B. Brick, Ernest G. Henrichon, Jr., Alan Citron, Robert W. Stout, and Larry Petri 31 Dec. 1968 171 p refs
(Contract F19628-67-C-0329)
(AD-685192; IRA-122-9; AFCRL-69-0042) Avail: CFSTI CSCL 9/4

This report contains the results of research on the Wiener Canonical Expansion of Bayes Optimum Filters. Investigation consisted of: (a) Application of the Wiener canonical expansion technique to various useful statistical decision, estimation, control and adaptive processing tasks. (b) Further characterization of the classes of processes for which the Wiener, or Wiener-like representation are valid and of the convergence rates and stationary requirements. (c) Examination of Wiener-like techniques. (d) Techniques and means for obtaining useful representations and samples of processes to be tested in suitable computer-compatible format. Author (TAB)

N69-29486# RAND Corp., Santa Monica, Calif.
THE SECOND-ORDER RYTOV APPROXIMATION
H. T. Yura Feb. 1969 18 p refs
(Contract F44620-67-C-0045)
(AD-684122; RM-5787-PR) Avail: CFSTI CSCL 20/6

An explicit and useful formulation of the solution for the second-order Rytov approximation is given. From this solution a condition of validity for the Rytov solution is obtained. It is concluded that, in general, both the Born and Rytov approximations have the same domain of validity. Author (TAB)

N69-29487# Maryland Univ., College Park. Dept. of Electrical Engineering
LECTURES ON CONTROLLABILITY AND OBSERVABILITY
Leonard Weiss Jan. 1969 88 p refs
(Grant AF-AFOSR-1646-69)
(AD-684592; AFOSR-69-0754TR; BN-590) Avail: CFSTI CSCL 12/1

The lecture notes are devoted to a detailed examination of the fundamental system-theoretic concepts of controllability, observability, reachability and determinability, and of the roles they play in certain specific areas of research in modern system theory. The mathematical models employed in this study range in sophistication from linear, constant coefficient, differential equations to nonlinear, time-varying functional-differential equations. Much of the material, especially that dealing with functional-differential systems is of very recent origin, and in many cases enables well known older results in controllability theory to be embedded within newer more general ones. An overall objective has been to incorporate a certain amount of self-containment and breadth in the presentation. Nonetheless, various aspects of the subject have not been covered. Author (TAB)

N69-29494# Los Alamos Scientific Lab., N. Mex.
CLUSTER NUMBER DISTRIBUTIONS ON THE SIMPLE QUADRATIC LATTICE (A MONTE CARLO CALCULATION)
W. A. Beyer and R. G. Schrandt 3 Dec. 1968 7 p refs
(Contract W-7405-eng-36)
(LA-4055) Avail: CFSTI

Results of a Monte Carlo computation of the distribution of cluster numbers and sizes on a 16×16 quadratic lattice are presented. Author (NSA)

N69-29497# Gulf General Atomic, San Diego, Calif.
EVALUATION OF U 233 CROSS SECTIONS WITH NUMERICAL ANALYSIS OF INTEGRAL EXPERIMENTS
R. C. Traylor 26 Sep. 1968 26 p
(Contract AT(04-3)-167)
(GAMD-8067) Avail: CFSTI

As an integral numerical evaluation of uranium 233 neutron cross sections, an analysis of three homogeneous water-moderated critical assemblies was undertaken. The analysis of these soft spectrum critical assemblies supplements the reactivity coefficient experiments with uranium 233 in the harder spectrum HTGR Critical Assembly. The three spherical assemblies are characterized by hydrogen-to-fissile atom ratios of 1521, 405, and 381; the first and last were bare while the H/U 233 = 405 assembly was reflected. To help understand the results of U 233 assembly analysis, a uranium 235 assembly with spectrum similar to the harder U 233 assemblies was also analyzed (H/U 235 = 525) using the latest evaluation of the better known cross sections for U 235. Multigroup one-dimensional diffusion theory and transport theory computer codes were used to calculate the effective multiplication constant of each assembly. Author (NSA)

N69-29539# Aerospace Research Labs., Wright-Patterson AFB, Ohio. Applied Mathematics Research Lab.
MORE ZEROS OF BESSEL FUNCTION CROSS PRODUCTS Final Report
Henry E. Fettis and James C. Caslin Dec. 1968 65 p ref
(AD-685235; ARL-68-0209) Avail: CFSTI CSCL 12/1

The report contains tables of the first five roots of the following transcendental equations: (a) J sub 0 (alpha) Y sub 0 (kalpha) = Y sub 0 (alpha) J sub 0 (k alpha); (b) J sub 1 (alpha) Y sub 1 (k alpha) = Y sub 1 (alpha) J sub 1 (k alpha); (c) J sub 0 (alpha) Y sub 1 (k alpha) = Y sub 0 (alpha) J sub 1 (k alpha) where J sub 0 (alpha), Y sub 0 (alpha), J sub 1 (alpha), Y sub 1 (alpha) are Bessel functions of order 0 and 1 respectively. In these equations, alpha is the unknown and k is a parameter which may assume any positive value, other than 0 or 1. However, because of symmetry, it is sufficient in the first two cases to tabulate the roots only for $0 < k < 1$. Author (TAB)

N69-29603 Washington State Univ., Pullman.
A TRANSFORM METHOD APPLIED TO COUPLED HARMONIC OSCILLATOR TYPE PROBLEMS
James Arthur Beck (Ph.D. Thesis) 1968 57 p
Avail: Univ. Microfilms: HC $3.00/Microfilm $3.00 Order No. 68-15770

The mathematical system studied is a model of the longitudinal vibrations of a one-dimensional, finite or semi-infinite lattice of coupled particles. A method is developed to solve the equations of motion for such systems when the coefficients are constants. The existence and uniqueness of a solution for not necessarily constant coefficients is demonstrated, and it is proved that the formal solutions obtained satisfy the equations of motion and the prescribed boundary conditions. It is also proved that under certain conditions the limiting solution for a finite system of particles is the solution for an infinite system of particles. Dissert. Abstr.

N69-29611# Decision Science, Inc., San Diego, Calif.
COMPETITIVE GOAL-SEEKING THROUGH EVOLUTIONARY PROGRAMMING Final Report, 23 Mar. 1965–14 Feb. 1969
Lawrence J. Fogel and George H. Burgin Feb. 1969 100 p refs
(Contract AF 19(628)-5927)
(AD-685177; DSI-105-F; AFCRL-69-0074) Avail: CFSTI CSCL 12/2

The investigation was to examine various ways in which finite-state machines and related mathematical techniques can be used to increase the likelihood of successful game-playing. More specifically, evolutionary programming offers a means for modeling the strategy of the opponent, thus permitting the improvement of play against an intelligent adversary. Mathematical experiments performed in computer simulation were used to demonstrate this capability. Additional experiments concerned pursuit/evasion games similar to those which arise in tactical situations. Author (TAB)

N69-29615 Texas Univ., Austin.
PSEUDO-MIXING SEQUENCES OF RANDOM VARIABLES
Charles Henry Farmer (Ph.D. Thesis) 1968 62 p
Avail: Univ. Microfilms: HC $3.60/Microfilm $3.00 Order No. 68-16076

The concept of mixing sequences of random variables was the model for the characterization of mixing transformations in terms of pseudo-δ-mixing transformations. A weakened form of pseudo-δ-mixing transformations is introduced and is called almost-pseudo-δ-mixing. If a transformation is pseudo-δ-mixing on a field, then the transformation is shown to be almost-pseudo-δ-mixing on the sigma-field generated by the field. A δ-ergodicity is introduced, and analogous results for ergodic transformations are obtained. Finally, pseudo-δ-mixing is shown to be an invariant under isomorphism. Dissert. Abstr.

N69-29622# California Univ., Berkeley. Operations Research Center.
OPTIMAL DISPATCHING OF A POISSON PROCESS Research Report
Sheldon M. Ross Nov. 1968 16 p refs
(Contracts Nonr-222(83); DA-31-124-ARO(D)-331; Grant NSF GP-8695)
(AD-685254; ORC-68-27) Avail: CFSTI CSCL 15/5

Items arrive at a processing plant at a Poisson rate lambda. At time T, all items are dispatched from the system. An intermediate dispatch time is to be chosen to minimize the total wait of all items. It is shown that if the dispatch time must be chosen at time 0 then T/2 not only minimizes the expected total wait but it also maximizes the probability that the total wait is less than a for every a > 0. If the intermediate dispatch time is allowed to be a (random) stopping time, then it is shown that the policy which dispatches at time t if N(t) = αr > lambda (T - t) is optimal, where N(t) denotes the number of items present at time t. The distribution of the optimal dispatch time and the optimal expected total wait are determined. A generalization to the case of a nonhomogeneous Poisson Process, a time lag, and batch arrivals is given. Finally, the case where the process goes on indefinitely and any number of dispatches are allowed (at a cost K per dispatch) is considered. Author (TAB)

N69-29633# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
RELATIVISTIC QUASIPOTENTIAL EQUATION WITH LOCAL INTERACTION
M. D. Mateev, R. M. Mir-Kasimov, and M. Friman 1968 31 p refs In RUSSIAN
(JINR-P2-4107) Avail: AEC Depository Libraries

Using the method of variation of contents, the integral equations were built for the wave functions of the continuous spectrum and the Jost functions were introduced. The analytic properties of the scattering matrix were considered for exactly solvable cases of the square-well and Coulomb potentials. Author (NSA)

N69-29638# Hungarian Academy of Sciences, Budapest. Central Research Inst. for Physics.
ON A SYMMETRY OF THE DIRAC EQUATION
A. Sebestyen 1968 13 p ref
(KFKI-31/1968) Avail: AEC Depository Libraries

It is shown that in a Poincaré covariant theory of a free Dirac particle an implicit symmetry group G emerges. Its representation is of the type $g(\in G) \rightarrow D^{(g)}_{\alpha\beta}(x - x')$ i.e., the effect of a transformation associated with the group element g on the spinor ψ is the following: $\psi'_\alpha(r) = \int D^{(g)}_{\alpha\beta}(x - x')\,\psi_\beta(x')\,d^4x'$. By requiring the Lagrangian to be invariant under these transformations, the generators are explicitly constructed, and it is seen that they constitute a six parameter Lie algebra and the neighborhood of the unity is mapped into matrices of the kind $\delta_{ik}\,\sigma(x - x') + \delta\eta^a\,G^a_{ik}(x - x')$. The algebra is locally isomorphic to the SO(4) algebra. By construction the requirements of covariance are fulfilled. NSA

N69-29648*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APPLICATIONS OF QUASILINEARIZATION THEORY TO SYSTEM IDENTIFICATION
George A. Zupp, Jr. and S. Bart Childs (Houston Univ.) Washington Jul. 1969 32 p refs
(NASA-TN-D-5300) Avail: CFSTI CSCL 12A

The theoretical development and application of quasi-linearization techniques to problems of system identification are presented. A one-degree-of-freedom system is used for the examples for the identification problems. Several numerical experiments are presented that relate the effects of noisy input data to the accuracy obtained in computing unknown parameters of the governing differential equations. Also presented are the application of quasi-linearization to the identification problems of automobile coasting and parachute dynamics. Conclusions from these experiments are included. Author

N69-29711*# Aztec School of Languages, Maynard, Mass. Research Translation Div.
THEORY OF NONEQUILIBRIUM PROCESSES IN STATISTICAL MECHANICS. III: INTEGRAL EQUATION FOR DENSITY MATRIX AND ROLE OF THE FREE HAMILTONIAN IN THE EVOLUTION OF THE DYNAMICAL SYSTEM [K TEORII NERVANOVESNYKH PROTSESSOV V STATISTICHESKOY MEKHANIDE. III: INTEGRALNOYE URAVNENIYE DLYA MATRITSY PLOTNOSTI I ROLSYO-BODNOGO GAMILTONIANA EVOLYUTSII DINAMICHES-KOY SISTEMY]
S. V. Peletminskiy et al. Washington NASA Jun. 1969 30 p refs Transl. into ENGLISH from Akad. Nauk URSR report IYF-68-5
(Contract NASw-1692)
(NASA-TT-F-12078; ITS-68-5) Avail: CFSTI CSCL 12A

It is shown on the basis of an asymptotic equation that, at least in the perturbation theory, the stationary solution to integral equations for the density matrix obtained is equivalent to the Gibbs distribution. The role of the free Hamiltonian is discussed, as is the principle of spatial relaxation of correlations for the initial state in the process of evolution of the system. An integral equation is obtained for the density matrix which is applicable for $t >> \tau_0$ as well as for $t \leq \tau_0$. An integral equation is also obtained for the generating functional determining the collision integral and multiparticle distribution function. Author

N69-29793*# North American Rockwell Corp., Downey, Calif. Space Div.
GENERALIZED QUASI-LINEARIZATION ROUTINES FOR SOLVING NONLINEAR BOUNDARY-VALUE PROBLEMS
John R. Radbill and Gary A. McCue 15 Dec. 1968 81 p refs Supersedes SID-66-394
(Contracts NAS8-5211; NAS8-20238; NAS8-21077)
(NASA-CR-98485; SD-68-1055; SID-66394) Avail: CFSTI CSCL 12A

This report describes an integrated group of IBM 360 FORTRAN H subroutines for solving multipoint boundary value problems through the use of quasi-linearization. In order to illustrate the somewhat different methodology and formulation required for quasi-linearization, a typical application involving the solution of a boundary layer equation is described. Next, the set of subroutines is completely described and documented. The subroutines are not an end in themselves but should be regarded as packages that will be modified and restructured as required by the future applications of various users. Author

N69-29804*# Polytechnic Inst. of Brooklyn, N.Y.
MINIMUM SENSITIVITY DESIGN OF ATTITUDE CONTROL SYSTEMS Final Report
J. J. Bongiorno, Jr. and P. Dorato [1968] 71 p refs
(Grant NGR-33-006-042)
(NASA-CR-101622; PIBEE-69-001) Avail: CFSTI CSCL 12A

Design techniques were developed for systems with uncertain parameters. Two classes of problems were treated. In the first class, statistical information concerning the system uncertainities is known. Only bounds on the certain parameters are known in the second class of problems investigated. With regard to the first class of problems, a minimum sensitivity design procedure for multivariable systems was developed. Some interesting results concerning systems subjected to additive noise disturbances were also derived. In particular, equations are available to investigate the change in system performance due to changes in the standard deviation of the additive noise. The results obtained for the first class of problems studied have limited usefulness in spacecraft attitude control system design. The second class of problems treated is more in line with the information presently available on the uncertain parameters in spacecraft attitude control systems. The approach taken assumes that for each choice of control scheme the uncertain parameters take on the values which will cause the worst performance. One then attempts to select that control whose worst performance is less than the worst performance for any other choice of control. This design approach is referred to as minimax design. Author

N69-29808# Florida State Univ., Tallahassee. Dept. of Statistics.
MULTIVARIATE PAIRED COMPARISONS: THE EXTENSION OF A UNIVARIATE MODEL AND ASSOCIATED ESTIMATION AND TEST PROCEDURES
Roger R. Davidson and Ralph A. Bradley Oct. 1968 26 p refs
(Contract Nonr-988(08))
(AD-685598; ONR-TR-33; FSU-M161) Avail: CFSTI CSCL 12/1

The study is concerned with the development of an extension of the Bradley-Terry Model for paired comparisons to situations in which responses to paired comparisons are obtained on each of several characteristics. At the outset a probability model for multivariate paired comparisons is proposed that may be represented in several distinct ways. An iterative procedure for obtaining maximum likelihood estimates of the parameters introduced into the model is given and its behavior examined in some detail. It is observed that the procedure generally performed well, the key to this conclusion being the relative stability of the initial estimates of the preference parameters. TAB

N69-29868# California Univ., Berkeley. Operations Research Center.
A COMPARATIVE INVESTIGATION OF THE COMPUTATIONAL EFFICIENCY OF SHORTEST PATH ALGORITHMS
Lewis E. Hitchner Nov. 1968 27 p refs
(Contract Nonr-222(83); Grant NSF GP-8695)
(AD-685619; ORC-68-25) Avail: CFSTI CSCL 12/2

Efficiency of shortest path algorithms is a function of various network parameters. This paper reports the results of an investigation of five algorithms for finding the shortest path from a root node to all other nodes for different network structures. Parameters considered are number of nodes, number of links, range of data (i.e., arc lengths), and shape (if applicable). It is hoped that the results will suggest to potential users of these algorithms which one is best suited for their problem. Author (TAB)

N69-29885# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
NONLINEAR DISTORTIONS AND OPTIMUM WORKING CONDITIONS FOR SEVERAL TYPES OF OPTICAL MODULATORS
A. P. Buryak, V. B. Gisin, and V. G. Koshelev Aug. 1968 9 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Radioelektronika (USSR), v. 10, no. 5, 1967 p 489–493
(AD-685000; FTD-HT-23-453-68) Avail: CFSTI CSCL 20/8

A method is presented for calculating the magnitudes of the nonlinear distortion factors for all slopes of the modulation curve of the Kerr cell. The numerical results obtained on the Minsk-1 computer are presented in the form of graphs showing the dependence of the distortion factor on the amplitude of the modulating voltage within the range of optimal displacement voltages for all five slopes of the modulation curve. The method is extended to cover the modulation based on the electrooptical (Pockels) effect, and a formula is obtained for determination of the distortion factor for optimal operation conditions. The calculation method is also applicable to modulation using linear or square-law magnetooptic effects. TAB

N69-29903# Southwest Center for Advanced Studies, Dallas, Tex.
THE AUTOMATIC NUMERICAL EVALUATION OF DEFINITE INTEGRALS
R. Cranley and T. L. N. Patterson 1968 34 p refs
(Contract N00014-67-A-0310)
(AD-685623; N00-SP-69-001) Avail: CFSTI CSCL 12/1

A critical examination is made of two common approaches to the automatic evaluation of definite integrals. It is shown that on the grounds of efficiency and reliability it is generally preferable to use families of common point high precision formulae directly over the whole interval of integration than to apply low precision formulae to an adaptively subdivided range. Many examples are given to illustrate the conclusions. Author (TAB)

N69-29951# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE PRINCIPLE OF INCREASING OF THE DEGREE OF INDETERMINACY OF BOOLEAN FUNCTIONS, AN ALGORITHM FOR DETERMINING THE SHORTEST DISJUNCTIVE NORMAL
Yu. N. Kornev Oct. 1968 27 p refs Transl. into ENGLISH from Kibernetika (Ukrainian SSR), no. 4, 1967 p 9–16
(AD-685533; FTD-MT-24-333-68) Avail: CFSTI CSCL 12/1

The article deals with investigating the properties of disjunctive normal forms (d.n.f.) realizing a partially definite Boolean function. The first part of the article examines a set of nonsimplifiable reduced d.n.f. (r.d.n.f.) derived by increasing the degree of indeterminacy of a given partially definite Boolean function. It is shown that a set of

nonsimplifiable r.d.n.f. does not contain any redundant information on irredundant d.n.f.(i.d.n.f.). The second part of the article illustrates the usefulness of the determination of the set of r.d.n.f. as exemplified by the construction of the shortest d.n.f. of a partially definite Boolean function phi(xi, ..., xn). It is demonstrated that one of the r.d.n.f., here termed the main nonsimplifiable r.d.n.f., engenders the set of i.d.n.f. of the function phi(xi, ..., xn), containing the shortest d.n.f. An algorithm for the construction of the i.d.n.f. that is the shortest in the interior of a set of i.d.n.f. of the function phi(xi, ..., xn) is presented and ways of improving this algorithm are considered. TAB

N69-29969# Deutsche Forschungsanstalt fur Luft- und Raumfahrt, Brunswick (West Germany). Institut fuer Flugfuehrung.
THE TRANSFER OF POLYNOMIAL MATRIX OPERATIONS INTO HYPERMATRIX EQUATIONS WITH CONSTANT COEFFICIENTS AND THEIR APPLICATION TO SOME EXAMPLES OF THE MULTIVARIABLE CONTROL [DIE UEBERFUEHRUNG VON POLYNOMMATRIZENOPERATIONEN IN UEBERMATRIZENGLEICHUNGEN MIT KONSTANTEN KOEFFIZIENTEN UND DEREN ANWENDUNG AUF EINIGE BEISPIELE AUS DER MEHRGROESSENREGELUNG]
Wolfgang Kubbat Jan. 1969 95 p refs In GERMAN; ENGLISH summary
(DLR-FB-69-18) Avail: CFSTI

Important mathematical numerical tasks in the use of polynomial matrices are multiplication, inversion and the determination the characteristical polynom of a polynominal matrix. A Laplace transformed system of differential equations, appearing on work with multivariable control, can be the origin of this polynominal matrice. The solution of this problem is given by a new method, that of applying hypermatrices. In comparison to common methods it is shown, that one avoids many numerical operations with this new method. For theoretical results there is generalizations of the Cayley-Hamilton-theorem and the Krylov-method for polynominal matrices. All considerations are demonstrated together with short numerical examples. Particularly the applicability of this new method for working with digital computers is shown. Author

N69-29970# Deutsche Forschungsanstalt fur Luft- und Raumfahrt, Brunswick (West Germany). Institut fuer Flugmechanik.
ON THE SYSTEMATIC AND STATISTICAL ERRORS IN THE SYSTEM ANALYSIS AT THE ANALOGUE COMPUTER BY MEANS OF RANDOM SIGNALS [UEBER DIE SYSTEMATISCHEN UND DIE STATISTICHEN FEHLER BEI DER SYSTEMANALYSE AM ANALOGRECHNER MIT HILFE STOCHASTISCHER SIGNALE]
Ruthard Koehler 26 Mar. 1969 85 p refs In GERMAN
(DLR-FB-69-19) Avail: CFSTI

In the analysis of a linear system with constant coefficient which is excited by random input and random noise, systematic and statistical errors affect the result. For the determination of the power spectra and the frequency response by means of known circuits which can be built up at the analogue computer, details are given on systematic and statistical errors. Author

N69-29973# Istituto Superiore delle Poste e delle Telecomunicazioni, Rome (Italy).
EVOLUTION OF A COHERENT STATE OF AN HARMONIC OSCILLATOR WITH TIME-DEPENDENT FREQUENCY
Bruno Crosignani, Paolo di Porto, and Salvatore Solimeno Fondazione U. Bordoni 5 Oct. 1968 6 p refs
Avail: CFSTI

The problem of a quantum harmonic oscillator with time-dependent frequency is considered for the case in which the initial state is a coherent one. A theoretical study introducing the coherent states as eigenvectors is discussed. Author (ESRO)

N69-30008# Weapons Research Establishment, Salisbury (Australia).
A NUMERICAL FORM OF THE PARAMETER INFLUENCE COEFFICIENT METHOD FOR PARAMETER ESTIMATION IN MATHEMATICAL MODELLING
R. G. Seacamp Jan. 1969 18 p refs
(WRE-TN-SAD-217) Avail: CFSTI

This note describes a form of the parameter influence coefficient method where the sensitivity coefficients are computed numerically instead of being analytically defined. This form allows the method to be more generally applicable to complex systems where the analytical definitions of the sensitivity coefficients are difficult to determine. The method has been programmed on an IBM 7090 digital computer, in FASTRAN and FAP, and tested on several types of problems. The results obtained are usually satisfactory and some simple examples are presented in this note. Author

N69-30024# Florida State Univ., Tallahassee. Dept. of Statistics.
A SYSTEM OF MARKOV CHAINS WITH RANDOM LIFE TIMES
Frederick W. Leysieffer Sep. 1968 16 p refs
(Contract Nonr-988(13))
(AD-685593; FSU-M144) Avail: CFSTI CSCL 12/1

Limiting properties of random variables associated with a system of random processes are investigated. Particles enter the system at integer times in random (Poisson) numbers, and at subsequent integer times are allowed to move independently according to a 2 dimensional random process, Markov in one dimension. Deaths of particles occur randomly. The random variables investigated are A sub n (B*), the number of particles in a finite set of states B* at time n and M sub n (B*;r), the number which have visited B* exactly r times by time n. TAB

N69-30025# Florida State Univ., Tallahassee. Dept. of Statistics.
MULTIVARIATE PAIRED COMPARISONS: SOME LARGE-SAMPLE RESULTS ON ESTIMATION AND TESTS OF EQUALITY OF PREFERENCE
Roger R. Davidson and Ralph A. Bradley Mar. 1969 27 p refs
(Contract Nonr-988(08))
(AD-685599; FSU-M162; ONR-TR-34) Avail: CFSTI CSCL 12/1

The paper is a second one on multivariate paired comparisons. The first paper contained the methodology and this paper contains some large-sample results on estimation and test of preference equality. The limiting normal distribution is derived for the joint distribution of estimators for attribute preferences and correlations; the dispersion matrix derived indicates desired asymptotic variances and covariances. The likelihood ratio test of equality of preference parameters has the noncentral chi-square limiting distribution and its noncentrality parameter is given under local alternatives. Asymptotic efficiencies of the method of paired comparisons relative to a multiple multivariate sign test are computed. TAB

N69-30028# Fondazione Ugo Bordoni, Rome (Italy).
TWO RAIL CASCADES [CATENE DI SHORT]
Guiseppe Fantauzzi 22 Mar. 1968 71 p refs In ITALIAN
Avail: CFSTI

The importance of cellular cascades for the realization of Boolean functions is discussed and the cascade proposed by short (two-rail cascade) is examined. The mathematical analysis is carried out using group and semigroup theories. Permutation cascades are also examined and various theorems are proved and analysed. ESRO

N69-30031# Florida State Univ., Tallahassee. Dept. of Statistics.
SEQUENTIAL ONE-SAMPLE GROUPED RANK TESTS
Ralph A. Bradley and Harrison D. Wood Feb. 1969 9 p refs
(Contract Nonr-988(08))
(AD-685597; FSU-M160; TR-32) Avail: CFSTI CSCL 12/1

Independent observations are taken in groups of size N sequentially. An hypothesis of symmetry about the origin for the distribution is compared with an alternative of the Lehmann class. Walds sequential analysis is used to develop two sequential rank tests, one of which is a sequential extension of Wilconons rank test. TAB

N69-30049# Fondazione Ugo Bordoni, Rome (Italy).
A NEW METHOD FOR THE DETERMINATION OF THE MINIMAL FORMS OF A BOOLEAN FUNCTION [UN NUOVO METODO PER LA RICERCA DEGLI IMPLICANTI PRIMI]
Giacomo Cioffi and Vincenzo Falzone 10 Apr. 1968 12 p refs In ITALIAN
Avail: CFSTI

A method for the determination of the minimal forms of a logic function using the same principles as for Karnaugh maps is proposed. The method leads to two algorithms which may be programmed in a digital computer using a small amount of memory space. The flow diagram for such programs is given. ESRO

N69-30058# Stanford Univ., Calif. Dept. of Statistics.
ESTIMATION OF SIMULTANEOUS SYSTEMS OF LINEAR EQUATIONS WITH NONLINEAR CONSTRAINTS AMONG THE COEFFICIENTS
Peter Ole Anderson 3 Mar. 1969 60 p refs
(Grant DA-ARO(0)-31-124-G1077)
(AD-684946; TR-26) Avail: CFSTI CSCL 12/1

The basic problem considered here is the estimation of the coefficients in a simultaneous system of linear equations. Maximum likelihood, linearized maximum likelihood, two-stage least-squares and three-stage least-squares methods have primarily been studied for the case of linear constraints among the coefficients. In this paper the case of nonlinear constraints is considered. It is shown that by linearizing the nonlinear constraints and using a three-stage least-squares procedure one can obtain similar large sample, and also small sigma, results. Author (TAB)

N69-30095# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France). Faculte des Sciences.
FIGURE EIGHTS ON THE SQUARE LATTICE: ENUMERATION AND MONTE CARLO ESTIMATION
S. G. Whittington (Toronto Univ.) and J. P. Valleau Mar. 1969 21 p refs
(Rept-69/21) Avail: CFSTI

The numbers of figure eights weakly embeddable in a lattice, important in the theories of self-avoiding walks and the Ising problem, are investigated. Two Monte Carlo techniques for estimating such numbers are outlined and were applied to the case of the square lattice. Enumerations were also carried out for this lattice, and extrapolation furmulas have been sought on the basis of these results. It is suggested that the numbers of large polygons and figure eights, having the same number of edges, become very similar. Some rigorous, but rather weak, bounds are established for the numbers of such figure eights. Author

N69-30128# Technical Univ. of Denmark, Lyngby. Dept. of Civil Engineering.
A DIRECT METHOD FOR DETERMINING MEAN PARAMETERS FROM SIEVE ANALYSIS DATA Technical Report
Fariborz Radjy Jan. 1969 12 p refs
(TR-5) Avail: CFSTI

By application of the theory of statistics, a direct method for evaluating mean parameters from sieve analysis data is developted. The method is applied to the evaluation of variance and specific surface area. This method is particularly suitable for use in conjunction with an electronic computer. Author

N69-30144# Stanford Univ., Calif. Dept. of Statistics.
AN EXACT LOWER CONFIDENCE BOUND FOR THE RELIABILITY OF A SERIES SYSTEM WHERE EACH COMPONENT HAS AN EXPONENTIAL TIME TO FAILURE DISTRIBUTION
Tapas K. Sarkar Mar. 1969 30 p refs
(Contract Nonr-225(53))
(AD-684860; TR-117) Avail: CFSTI CSCL 14/4

Consider a complex system consisting of several components in series. The system as a whole is either impossible or too expensive to test. The only data available are the times to failure of the components when tested individually. Based on these data an exact lower confidence bound for the reliability of the system is obtained. Initially, the method is developed for the case when the components are independent. Later the method has been extended to the case when the components are dependent and have multivariate exponential time to failure distribution. The sampling method considered is type II censoring of r out of n with or without replacement. An asymptotically smallest confidence interval has also been developed. Author (TAB)

N69-30147# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE CONVERGENCE OF THE METHOD OF LINES IN THE SOLUTION OF CERTAIN QUASILINEAR BOUNDARY VALUE PROBLEMS
V. N. Abrashin [1969] 5 p refs Transl. into ENGLISH from Izv. Akad. Nauk Belorussk. SSR, Ser. Fiz.-Tehn. (Minsk), no. 2, 1969 p 38-42
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Results of boundary value problem solutions for linear equations of the parabolic and hyperbolic types are extended to quasi-linear equations. A method of lines of elevated accuracy is used by approximating the original problem by a Cauchy problem for a system of ordinary differential equations. A.C.R.

N69-30155# Fondazione Ugo Bordoni, Rome (Italy).
SOME PROPERTIES OF THE TREE STRUCTURES REPRESENTING LOGICAL FUNCTIONS [ALCUNE PROPRIETA DELLE RAPPRESENTAZIONI DI FUNZIONI LOGICHE SU STRUTTURE AD ALBERO]
Giacomo Cioffi and Vincenzo Falzone 21 Feb. 1968 31 p refs In ITALIAN
Avail: CFSTI

The characteristics and properties of a binary tree structure applied to Boolean functions are described. The tree is divided into strings and blocks. Their relationships are described and various theorems are proved. A mathematical analysis of the tree structure and also of the intersections of many trees is given. The results obtained may be used for the synthesis of cellular logic circuits. ESRO

N69-30183# Fondazione Ugo Bordoni, Rome (Italy).
APPROXIMATION OF TRANSFER FUNCTIONS IN THE FREQUENCY RANGE [APPROSSIMAZIONE DI FUNZIONI DI RETE NEL DOMINIO DELLA FREQUENZA]
Giuseppe Martinelli 28 Jun. 1968 113 p refs In ITALIAN
Avail: CFSTI

Transfer functions of an electric network are complex functions of complex variable (frequency s). The problem is to find another function approximating to the above which is simpler and more convenient to use. Different methods of approximation are considered e.g. linear methods, numerical methods and an application of the latter to a low-pass transfer function is described. The criteria defining the effectiveness of an approximation are also discussed. ESRO

N69-30187# California Univ., Los Angeles. Western Management Science Inst.

A DECISION-MAKING MODEL FOR APPLICATIONS OF QUEUEING THEORY

Rosser T. Nelson Feb. 1969 28 p refs *Its* Working Paper No. 147

(Contract Nonr-047(75))

(AD-684825) Avail: CFSTI CSCL 12/2

This paper describes a decision-making model which may be useful in potential applications of queueing theory to systems for which the input (arrival) characteristics are dependent upon system performance statistics as well as upon the values assumed by certain decision variables. The model may be viewed as a generalization of the type of cost model usually encountered in the queueing literature. The use of the model is first illustrated for a simple Poisson-exponential service facility for which solutions are obtainable in closed-form and sensitivity to parameters is easily explored. Extensions of the basic example are discussed and a nonlinear programming algorithm is applied to the Poisson arrival, constant service time variation of the problem to obtain some comparative results. Author (TAB)

N69-30197# Boeing Scientific Research Labs., Seattle, Wash. Information Sciences Lab.

A SUCCESSIVE APPROXIMATION PROCEDURE FOR NONLINEAR DATA SMOOTHING

J. S. Meditch Dec. 1968 27 p refs

(AD-685546; D1-82-0803; ISL-25) Avail: CFSTI CSCL 12/1

A Newton-Raphson differential correction procedure is developed to solve the nonlinear two-point boundary-value problem of fixed interval data smoothing for noisy nonlinear dynamic systems. A numerical example is included to illustrate the procedure. Author (TAB)

N69-30207# Basel Univ. (Switzerland). Mathematics Inst.

ON THE SCHUR COMPLEMENT

Emilie V. Haynsworth Jun. 1968 8 p refs

(Contract DA-91-591-EUC-3946)

(AD-673276; BMN-20) Avail: CFSTI CSCL 12/1

Suppose B is a nonsingular principal submatrix of an NXN matrix A. We define the Schur complement of b in a, denoted by (a/b), as follows: let a" be the matrix obtained from a by a simultaneous permutation of rows and columns which puts B into the upper left corner of A". Then (A/B) = G - D(B superscript -1)C. Schur proved that the determinant of A is the product of the determinants of any non-singular principal submatrix B with its Schur complement. The inertia of an hermitian matrix A is given by the ordered triplet, in A = (pi, nu, delta). Where pi denotes the number of positive, nu the number of negative, and delta the number of zero roots of the matrix A. In a previous paper it was shown that the inertia of an Hermitian matrix can be determined from that of any non-singular principal matrix together with that of its Schur complement. That is, if A is Hermitian and B is a non-singular principal submatrix of A, then in A = In B + IN (A/B). This result is used to prove an extension of a theorem by Marcus. Author (TAB)

N69-30212# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.

NEARLY BEST LINEAR UNBIASED ESTIMATION OF THE MEAN AND STANDARD DEVIATION OF THE LOGISTIC DISTRIBUTION

Joe W. Rodgers (M.S. Thesis) Dec. 1968 431 p refs

(AD-685115; GRE/MATH/68-12) Avail: CFSTI CSCL 12/1

The method of nearly best linear unbiased estimation, which was developed through order statistics, for obtaining unbiased estimators for use in estimating the location and scale parameters of continuous distribution is applied to the logistic distribution. Coefficients for multiplying ordered logistic statistics are developed for full and censored samples of size N = 15(1)60. Two types of censoring are used. First, each sample size, N, is censored from above. The second type of censoring is symmetrical double censoring from both ends. Extensive coverage is given to the development of the estimator in general and the application to the logistic distribution. Author (TAB)

N69-30214# Cornell Univ., Ithaca, N. Y. Dept. of Operations Research.

LADDER REGENERATIVE EVENTS WITH APPLICATIONS TO DAM MODELS

Michael Rubinovitch Dec. 1968 128 p refs

(Contract Nonr-401(53))

(AD-684859; TR-59) Avail: CFSTI CSCL 12/2

For a stochastic process {X(t), t greater than or equal to 0} with stationary independent increments, we define an event called a ladder event. The event is a regenerative event in the sense of Kingman. Conditions for the event to be standard or stable are given and its local time properties, limiting properties, and sample function behavior are investigated. It is found that there are two classes of processes with stationary independent increments, for one class the event is standard while for the other it is degenerative. Ladder epochs for X(t) are introduced as first passage times. Their behavior is characterized using the ladder events. The connection between ladder epochs and the supremum functional for X(t) is used to obtain limit theorems for the latter for a large class of processes with stationary independent increments. Ladder events, ladder epochs and the supremum functional are further studies for the special process which is representable as the sum of two independent processes, one, a process with stationary independent increments, and the other, a compound Poisson process. The approach here uses a continuous time extension of Fellers combinatorial lemma. Finally, these results are applied to investigate a general dam model. Author (TAB)

N69-30221# Stanford Univ., Calif. Dept. of Computer Science.

FORMALIZATION OF PROPERTIES OF RECURSIVELY DEFINED FUNCTIONS

Zohar Manna and Amir Pnueli 12 Mar. 1969 26 p refs

(Contract ARPA SD-183)

(AD-685614; AI Memo-82) Avail: CFSTI CSCL 12/1

The paper is concerned with the relationship between the convergence, correctness and equivalence of recursively defined functions and the satisfiability (or unsatisfiability) of certain first-order formulas. Author (TAB)

N69-30224# Boeing Scientific Research Labs., Seattle, Wash. Mathematics Research Lab.

RANDOM NUMBERS FALL MAINLY IN THE PLANES

George Marsaglia Aug. 1968 9 p refs *Its* Mathematical Note-582

(AD-685578; D1-82-0708) Avail: CFSTI CSCL 12/1

Most of the worlds computer centers use congruential random number generators. This note points out that such random number generators produce points in 2,3,4,... dimensions which are too regular for many Monte Carlo calculations. The trouble is that the points fall exactly on a lattice with quite a gross structure. The paper gives details of the degree of regularity of such generators in terms of sets of relatively few parallel hyperplanes which contain all of the points produced by the generator. Author (TAB)

N69-30231# Sticht voor Fundamenteel Onderzoek der Materie, Jutphaas (Netherlands). Instituut voor Plasma-Fysica.

ON THE MARGINAL STABILITY OF LINEARIZED SYSTEMS

F. Santini Feb. 1969 30 p refs Sponsored in part by Euratom

(Rept-69-51) Avail: CFSTI

The proglem of the stability of a perturbed linearized system for modes proportional to $\Xi(\tau)e^{i\omega t}$ yields an equation of the form $H(\omega)\Xi = 0$. General properties of the operator $H(\omega)$ give information on the stability of the admitted modes. The problem studied regards conditions for marginal stability (appearance of an unstable solution near one known to exist at some real frequency ω). So far this problem has been studied for equations $H(\omega)\Xi = 0$ derivable from a Lagrangian, admitting a regular solution, while $H(\omega)$ is Hermitian for real ω. The main purpose of the present work is to investigate the marginal stability for more general systems including those which admit, in the limit of ω becoming real, a degenerate eigenvalue ω, singular solutions, or non-Hermitian operators. Author

N69-30238# Iowa Univ., Iowa City. Dept. of Mathematics.
S-SEMIGROUPS OF AUTOMATA
Arthur C. Fleck and Stephen T. Hedetniemi Mar. 1969 14 p refs
(Contract N00014-68-A-0500; Proj. Themis)
(AD-684842; THEMIS-UI-TR-6) Avail: CFSTI CSCL 6/4

A new means of associating a semigroup with an automaton is presented. Some preliminary results are reported that suggest that this new class of semigroups more faithfully carries the structure of the original automaton than the classical semigroup approach does. Author (TAB)

N69-30239# Florida State Univ., Tallahassee. Dept. of Statistics.
SOME NORMALIZING TRANSFORMATIONS OF THE MULTIPLE CORRELATION COEFFICIENT
Vincent Hodgson Dec. 1968 19 p refs
(Contract Nonr-988(08))
(AD-685594; FSU-M147; ONR-TR-30) Avail: CFSTI CSCL 22/1

Three normal approximations to the sampling distribution of the multiple correlation coefficient are proposed and investigated. The approximations are not as accurate as Gurlands new approximation based on the F distribution but do have the advantage of being based on the more convenient and more thoroughly tabulated normal distribution. TAB

N69-30248*# Techtran Corp., Glen Burnie, Md.
NATURAL OSCILLATIONS OF NEARLY CYLINDRICAL SHELLS [O SOBSTVENNKH KOLEBANIYAKH OBOLOCHEK MALO OTLICHAYUSHCHIKHSYA OT TSILINDRICHESKIKH]
T. D. Karimbayev et al Washington NASA Jul. 1969 16 p refs Transl. into ENGLISH from Izv Akad. Nauk Kaz. SSR, Ser. Fiz.-Mat. Nauk (Alma-Ata), no. 3, 1965 p 26-35
(Contract NASw-1695)
(NASA-TT-F-12326) Avail: CFSTI CSCL 12A

The present work investigates the effect of axisymmetric deviations on the frequencies of natural oscillations of nearly cylindrical thin shells which are parabolic in form. In so doing, the method of the small parameter is used which characterizes the maximum deviation of the shell in question from the cylindrical. Author

N69-30277# Stanford Univ., Calif. Dept. of Computer Science.
REFINEMENT THEOREMS IN RESOLUTION THEORY
David Luckham 24 Mar. 1969 33 p refs Presented at the IRIA Symp. on Autom. Deduction, Versailles, France, 16-21 Dec. 1968
(Contract ARPA SD-183)
(AD-685613; A.I. Memo-81) Avail: CFSTI CSCL 12/1

The paper discusses some basic refinements of the Resolution Principle which are intended to improve the speed and efficiency of theorem-proving programs based on this rule of inference. It is proved that two of the refinements preserve the logical completeness of the proof procedure when used separately, but not when used in conjunction. The results of some preliminary experiments with the refinements are given. Author (TAB)

N69-30278# Cornell Univ., Ithaca, N. Y. Dept. of Theoretical and Applied Mechanics.
ON THE DERIVATION OF SOLUTIONS DUE TO A POINT SOURCE FROM LINE SOURCE RESPONSES
Stephen A. Thau and Yih-Hsing Pao Feb. 1969 31 p refs
(Contract DASA01-68-C-0041)
(AD-684854; DASA-2194) Avail: CFSTI CSCL 20/10

A sequence of linear, mathematical operations are derived which transform the generalized function representing a concentrated line source into the generalized function representing an axi-symmetric point source. Geometrically, the transformation consists of superposing the derivatives of the Hilbert transforms of line sources in all azimuths through a given point, to produce a concentrated source at that point. Thus, for linear systems the response due to a point source can be deduced from that due to line sources by the same operations. Conditions for which the transformation becomes useful and various alternate forms of the transformation, with examples, are also given. Author (TAB)

N69-30291# Ballistic Research Labs., Aberdeen Proving Ground, Md.
A THREE-PARAMETER FAMILY OF STABLE DIFFERENCE METHODS FOR ONE-DIMENSIONAL ACOUSTIC VIBRATIONS
John H. Giese Feb. 1969 15 p refs
(AD-684905; BRL-MR-1983) Avail: CFSTI CSCL 20/11

A three-parameter family of difference methods for solving the system of partial differential equations of one-dimensional acoustic vibrations is determined. Insistence on stability, combined with a demand to maximize the permissible value of delta t/delta x leads us to rediscover Laxs method for one-dimensional acoustics. Author (TAB)

N69-30309# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France). Faculte des Sciences.
OMEGA-PHI MASS-MIXING MODEL EQUAL-TIME COMMUTATION RELATIONS OF SUGAWARA AND SYMMETRY BREAKING ALGEBRA OF FIELDS
E. Cremmer May 1969 26 p refs
(Rept-69/26) Avail: CFSTI

A broken-symmetry theory of currents with new equal-time commutators is described, and its consistency with an omega-phi mass mixing model is analyzed. Using this method, the decay widths of neutral vector mesons into lepton pairs can be predicted. A sum rule is also formulated which implies SU(3) symmetry for several coupling constants. Implications of Lorentz invariance on commutators involving current derivatives show that the consistency conditions for conserved currents are satisfied by the new equal-time commutation relations. Finally, a field algebra model with symmetry-breaking in the mass terms is developed. A.C.R.

N69-30315# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
NEARLY BEST LINEAR UNBIASED ESTIMATION OF THE LOCATION AND SCALE PARAMETERS OF THE WEIBULL PROBABILITY DISTRIBUTION BY THE USE OF ORDER STATISTICS
Francis B. Stump (M.S. Thesis) Dec. 1968 263 p refs
(AD-685116; GRE/MATH/68-13) Avail: CFSTI CSCL 12/1

Five-decimal-place tables are given for the coefficients for nearly best linear estimation of the location and scale parameters of the Weibull distribution. With the shape parameter known, the least squares method of linear estimation as applied to order

statistics was used to determine the coefficients of estimation. The tabled coefficients are for the shape parameter equal to 0.5(0.5)2.0(1.0)4.0 with a sample size of N=10(1)40. M-order-statistic parameter estimators are tabled for censored samples with various values of r sub 2 largest observations missing. Also included is the relative efficiency of the estimators. Author (TAB)

N69-30331# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Lab.
A NEW METHOD FOR SOLVING A SYSTEM OF COUPLED RATE EQUATIONS
Alfred M. Kaufman Nov. 1968 23 p refs
(Contract N00014-67-C-0141)
(AD-685603; LMSC-N-15-68-2) Avail: CFSTI CSCL 12/1

Solutions in a functional form natural to the set of coupled rate equations are generated. The time step over which these solutions are valid is then defined from the criterion that these functional forms shall satisfy the differential equation to within a predescribed error. Author (TAB)

N69-30340# Florida State Univ., Tallahassee. Dept. of Statistics.
SURVEILLANCE PROBLEMS: TWO-DIMENSIONAL SYMMETRIC RANDOM WALK UNDER CONTINUOUS SURVEILLANCE
C. Bradley Russell Jul. 1968 29 p refs
(Contract Nonr-988(13))
(AD-685592; FSU-M143) Avail: CFSTI CSCL 12/2

The paper a sequel to AD-655 159, is concerned with optimal strategies for controlling a two-component symmetric random walk production process under continuous surveillance. Either or both components may be repaired at any time at some cost. A form of long-run average income is used as the criterion for comparing strategies. The class of non-randomized stationary strategies which do not permit hesitation and which allow production on only a finite number of states is shown to be a complete class of strategies under certain assumptions of monotonicity and symmetry on the income function. Properties of optimal strategies are derived and methods are given for evaluating the income criterion for the admissible strategies. The results are applied to obtaining the optimal strategy in a numerical example. Author (TAB)

N69-30358# Lockheed Missile and Space Co., Palo Alto, Calif.
ON SOME REGULARIZATION METHODS FOR THE NUMERICAL EVALUATION OF A SECOND-ORDER ORDINARY DIFFERENTIAL EQUATION
I. N. Molchanov [1969] 2 p refs Transl. into ENGLISH from Dopovidi Akad. Nauk Uk. RSR, Ser. A (Kiev), no. 4 1969 p 310-331
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

A numerical method for solving a boundary value problem for a second order ordinary differential equation which has no unique solution is considered. The difference problem for the solution of the second order equation is reduced to a difference problem for a fourth order equation with regularized boundary conditions. Two regularization methods are proposed for the solution of a second order ordinary differential equation. Author

N69-30384# Air Force Inst. of Tech., Wright-Patterson AFB, Ohio. School of Engineering.
SIMULTANEOUS ESTIMATION OF THE SCALE AND LOCATION PARAMETERS OF THE GAMMA PROBABILITY DISTRIBUTION BY USE OF ORDER STATISTICS
Guy A. Morgan (M.S. Thesis) Dec. 1968 385 p refs
(AD-685114; GRE/MATH/68-8) Avail: CFSTI CSCL 12/1

A technique is outlined for simultaneously estimating the location and scale parameters of a Gamma distribution with known shape parameter. The estimators are nearly best linear unbiased estimators (NBLUE). The Gamma distribution is defined and important moments of the Gamma derived. Values of sets of estimator coefficients are listed in a table. A thorough explanation of the table, along with a detailed example of its use, is given. Table ranges include shape parameters equal to 1.0(0.5)4.0 for samples of size 15(1)40. Author (TAB)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N69-29025# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A DIFFERENCE SCHEME FOR SHORT-TERM WEATHER FORECASTING BY MEANS OF COMPLETE EQUATIONS. A THREE-DIMENSIONAL MODEL
D. Ya. Pressman 5 Mar. 1968 19 p refs Transl. into ENGLISH from Tr. Mirovoi Meteorol. Tsentr USSR (Moscow), no. 14, 1966 p 23-35
(AD-683176; FTD-HT-23-1559-67) Avail: CFSTI CSCL 4/2

A difference scheme is examined by means of which an attempt was made to integrate directly hydrodynamic equations containing the mechanism of external and internal gravitational waves. Sound waves were filtered out by assuming a hydrostatic state. In so doing it was assumed that the processes occur adiabatically, friction is absent, and the Earth's surface coincides with level P equations. TAB

N69-29050# Weather Wing (3rd), Offutt AFB, Nebr.
AN INVESTIGATION OF WINTER FOG AND STRATUS AT McCOY AFB, FLORIDA
Frank G. Johnson Feb. 1968 29 p refs
(AD-683762; TN-69-2) Avail: CFSTI CSCL 4/2

The report correlates wind, temperature and dewpoint depression at 1700 L with various categories of fog or stratus occurring during the morning hours at McCoy AFB, Florida. Author (TAB)

N69-29055# Weather Bureau, Fort Worth, Tex. Southern Region Headquarters.
APPLICATIONS OF COMMUNITY ANTENNA TELEVISION (CATV) SYSTEMS TO PUBLIC WEATHER DISSEMINATION
R. O. Reinhold and Carl M. Reber Jan. 1969 17 p
(PB-182831; WBTM-SR-43) Avail: CFSTI CSCL 04B

The study was undertaken to examine the present and future potential of Community Antenna Television (CATV) systems for disseminating public weather information. The study reviews the development and growth of CATV and suggests some possible weather applications. It is concluded that an all-weather channel on CATV holds considerable potential for providing the general public with a full-time weather information service. It is further concluded that general availability of such service to the public is dependent on growth of CATV market areas to make it economically feasible to support the cost of the weather service. Author (USGRDR)

N69-29212# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
USING HOT-WIRE ANEMOMETERS FOR AIRBORNE METEOROLOGICAL MEASUREMENTS
Mace T. Miyasaki *In* Md. Univ. Advan. in Hot-Wire Anemometry Jul. 1968 p 120–133 Sponsored by the Navy (See N69-29201 16-14)
Avail: CFSTI

An airborne array was flown at Wallops Island, Virginia, as part of a program to study clear air turbulence and the fine structure of the atmosphere with high power, multi-frequency radar systems. A number of hot-wire anemometers were placed on the array to gather data to study the turbulent structure characteristics of the atmospheric layers. These data were to be correlated with simultaneous temperature, refractivity, and radar echo measurements. Author

N69-29437 Illinois Univ., Urbana.
MODELING URBAN ATMOSPHERIC TEMPERATURE PROFILES
Mackenzie Leo Davis (Ph.D. Thesis) 1968 172 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-1330

The possibility of modeling the effect of the urban heat island on atmospheric stability was investigated. After establishing the fact that the city of Fort Wayne, Indiana did significantly increase the nocturnal atmospheric temperature over that of its rural environs, some consideration was given to the reasons for this effect. It was found that heat resulting from fuel consumption and the more efficient heat storage properties of the city structure contributed approximately 30 percent more heat to the urban environment than was available to the rural environment. Other sources of heat energy did not appear to be of significant consequence in effecting the urban–rural temperature difference. A model law based on the Monin–Obukhov scale length of turbulence was developed for use in comparing the model and prototype in autogenous atmospheric simulation. Dissert. Abstr.

N69-29670# Travelers Research Center, Inc., Hartford, Conn.
THE DEVELOPMENT OF A MULTI-STATION PHYSICAL MODEL FOR THE SIMULATION OF SUBSYNOPTIC SCALE METEOROLOGICAL PROCESSES, VOLUME 1 Final Report
Duane S. Cooley, Joseph P. Pandolfo, and Marshall A. Atwaters Dec. 1968 156 p refs
(Contract CWB-11256)
(PB-182801; TRC-7475-303a-Vol-1) Avail: CFSTI CSCL 04B

With the support of the Weather Bureau, Environmental Science Services Administration, The Travelers Research Center, Inc. has developed a working quasi-automated system of data processing and an automated physical-numerical model for the prediction of many meteorological parameters in the boundary layer. The physical prediction model produces vertical profiles of wind, temperature specific humidity, specific liquid water content, and other parameters at selected station locations over a period of 12 hours from initial time. The model also predicts the surface heat balance temperature. The basic differential equations solved are the conservation laws for horizontal momentum, heat, water vapor and total water substance. Author (USGRDR)

N69-29671# Travelers Research Center, Inc., Hartford, Conn.
THE DEVELOPMENT OF A MULTI-STATION PHYSICAL MODEL FOR THE SIMULATION OF SUBSYNOPTIC SCALE METEOROLOGICAL PROCESSES, VOLUME 2 Final Report
Duane S. Cooley, Marshall A. Atwaters, Gerald C. Wickham, and Gordon B. Lassow Dec. 1968 149 p refs
(Contract CWB-11256)
(PB-182802; TRC-7475-303b-Vol-2) Avail: CFSTI CSCL 4B

A series of sixteen computer programs, including modifications of data handling and objective analysis programs previously prepared for the Federal Aviation Agency, were used to produce a Multi-station Physical Boundary Layer Model Program System. The programs accept airways weather data prepared on magnetic tape from the Automatic Data Interchange System (ADIS), weather data from the Atlantic City mesonetwork prepared on magnetic tape, and other surface and upper air data. These data are merged, objective analyses of surface weather parameters are prepared, and horizontal gradients and other functions of the parameters are derived. Initial vertical profiles and upper and lower boundary conditions for each of the prediction stations are prepared. A description of the program system with its options and restrictions is given. Author (USGRDR)

N69-29683# Weather Squadron (8th), Detachment 7, Plattsburgh AFB, N.Y.
TERMINAL FORECAST REFERENCE FILE, VOLUME 1
Feb. 1969 70 p
(AD-683768) Avail: CFSTI CSCL 4/2

Reference file for forecasters containing a description of the local area, climatology, weather regimes, rules of thumb, and forecast studies. TAB

N69-29676# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MODERN PROBLEMS OF CLIMATOLOGY
M. I. Budyko et al 29 Nov. 1967 546 p refs Transl. into ENGLISH of the book "Sovremennyye Problemy Klimatologii" Leningrad, Izd.-Stvo, 1966 p 1–450
(AD-670893; FTD-23-1338-67) Avail: CFSTI CSCL 4/2

The articles focus on modern concepts and results of investigations on problems of thermal balance, atmospheric circulation, agrometeorology, and applied climatology. For individual titles, see N69-29677 through N69-29704.

N69-29677# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE THERMAL BALANCE AS A PROBLEM OF CLIMATOLOGY
M. I. Budyko *In its* Mod. Prob. of Climatology 29 Nov. 1967 p 10–21 refs (See N69-29676 16-20)
Avail: CFSTI

A review is presented of the investigations of thermal balance developed in modern meteorology. The capabilities of using data on the thermal balance for the development of various problems of climatology are analyzed. Author

N69-29680# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE ROLE OF EVAPORATION IN THE THERMAL BALANCE OF THE CONTINENTS
L. I. Zubenok *In its* Mod. Prob. of Climatology 29 Nov. 1967 p 53–63 refs (See N69-29676 16-20)
Avail: CFSTI

The role of evaporation in the thermal balance of the continents and the nature of the arrival of moisture to the continents are analyzed as a function of the relationship between evaporation and evaporation capacity. The processes of evaporation which occur in nature have long attracted the attention of meteorologists and climatologists. Actually, as the main component of the thermal and water balances, evaporation is the interconnecting link between meteorological and hydrological processes. This is the reason for the essential role of evaporation in processes of thermal interaction and moisture exchange between the underlying surface and the atmosphere. Author

N69-29681# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
REGULARITIES OF THE THERMAL BALANCE OF NATURAL SURFACES
M. P. Timofeyev et al *In its* Mod. Prob. of Climatology 29 Nov. 1967 p 64–82 refs (See N69-29676 16-20)
Avail: CFSTI

The results are presented from an experimental study of the thermal balance of land surface in the territory of the USSR, and from investigations of the thermal balance of internal bodies of water (lakes and reservoirs) conducted in a geophysical observator. The material produced allowed a clarification of the quantitative regularities of the redistribution of solar heat as a function of the properties of the underlying surface. Author

N69-29682# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE THERMAL BALANCE OF THE ACTIVE LAYER OF A FOREST
Yu. L. Rauner *In its* Mod. Prob. of Climatology 29 Nov. 1967 p 83–95 refs (See N69-29676 16-20)
Avail: CFSTI

Specific features of the vertical distribution of the coefficient of turbulence, radiation fluxes, turbulent heat exchange and latent heat of evaporation within vegetation are determined experimentally for the daylight hours. These quantities are correlated with biometric indicators of the plant cover (relative area of leaves, needles and trunk portion of trees) and the dependences produced are analyzed. In this work, particular attention has been turned to experimental study of the components of the radiation-thermal and water balance of various types of plant covers (forest, steppe, meadow, and agricultural crops). Author

N69-29683# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATION OF THE THERMAL BALANCE OF CENTRAL ASIA
B. A. Ayzenshtat *In its* Mod. Prob. of Climatology 29 Nov 1967 p 96–136 refs (See N69-29676 16-20)
Avail: CFSTI

An analysis of the results of investigation of the thermal balance of plains and mountain territory of Central Asia is presented. Attention is turned to the problem of formation of differences in soil-plant cover terrain on the eastern and western slopes of valleys characterized by increased moisturization by precipitation during the spring and summer period. Author

N69-29684# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE THERMAL BALANCE OF THE CAUCASUS
E. M. Shikhlinskiy *In its* Mod. Prob. of Climatology 29 Nov. 1967 p 137–155 refs (See N69-29676 16-20)
Avail: CFSTI

Using the Caucasus as an example, regularities of the radiation and thermal balance under mountainous conditions are analyzed. The specifics of the distribution of terms of the balance are determined as a function of the vertical zonality and their relationship with the meteorological elements is analyzed. Author

N69-29685# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOME PROBLEMS OF DYNAMIC CLIMATOLOGY IN THE WORKS OF A. I. VOYEYKOV AND THEIR CONTEMPORARY DEVELOPMENT
B. L. Dzerdzeyevskiy *In its* Mod. Prob. of Climatology 29 Nov. 1967 p 156–178 refs (See N69-29676 16-20)
Avail: CFSTI

The thoughts and ideas of A. I. Voyeykov which predicted the paths of development of theoretical and synoptic climatology are analyzed. The basic problems of modern theoretical climatology, including long term weather prediction and climate conversion are briefly characterized. The cases of fluctuation of the general circulation and elements of the climate are analyzed. Author

N69-29686# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SOME PROBLEMS IN THE OVERALL CIRCULATION OF THE EARTH'S ATMOSPHERE
Kh. P. Pogosyan *In its* Mod. Prob. of Climatology 29 Nov. 1967 p 179–186 refs (See N69-29676 16-20)
Avail: CFSTI

Problems of the overall circulation of the atmosphere and typization of synoptic processes are discussed. It is suggested that the empirical and hydrodynamic investigations be expanded in order to discover new regularities in the overall circulation of the atmosphere, not being limited only to problems of long term weather prediction. It is emphasized that the overall circulation is now being studied not only in the troposphere but in the stratosphere and mesosphere. Author

N69-29687# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ATMOSPHERIC CIRCULATION IN THE TROPICS
S. P. Khromov *In its* Mod. Prob. of Climatology 29 Nov. 1967 p 187–214 refs (See N69-29676 16-20)
Avail: CFSTI

The contemporary state of such problems of tropical meteorology as the relationship of the primary transfer and perturbations in the mechanism of air exchange, energy, and moment of rotation; aerological–climatological features of the Indian monsoon; types of tropical disturbances; the structure of the intertropical convergence zones; and the structure and genesis of tropical hurricanes are analyzed. Author

N69-29688# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE MONSOONS OF ASIA
O. G. Sorochyan *In its* Mod. Prob. of Climatology 29 Nov. 1967 p 215–235 refs (See N69-29676 16-20)
Avail: CFSTI

A brief characterization of the primary theories existing in meteorology relative to the nature of the monsoons of the earth is presented. Considerations are given concerning the thermodynamic nature of monsoons and their place in the system of overall circulation of the atmosphere. A detailed investigation is presented for the monsoons on the southern and eastern coastlines of the continent of Asia. Author

N69-29689# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CIRCULATION OF THE ATMOSPHERE IN THE MIDDLE AND HIGH LATITUDES OF THE SOUTHERN HEMISPHERE
G. M. Tauber *In its* Mod. Prob. of Climatology 29 Nov. 1967 p 236–248 refs (See N69-29676 16-20)
Avail: CFSTI

A brief review is presented of the results of investigations of atmospheric circulation in the southern hemisphere, conducted by Soviet and foreign authors in the past decade. Comparison of various synoptic characteristics for the two hemispheres is used to determine the primary differences in the conditions of circulation which are dependent of the distribution of land and ocean. Author

N69-29690# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE ROLE OF THE OVERALL CIRCULATION OF THE ATMOSPHERE AND MOISTURE EXCHANGE IN THE FORMATION OF DROUGHTS AND FLUCTUATIONS OF THE LEVEL IN BODIES OF WATER

O. A. Drozdov *In its* Mod. Prob. of Climatology 29 Nov. 1967 p 249–259 refs (See N69-29676 16-20)
Avail: CFSTI

The role of circulation and hydrothermal factors in the formation of droughts and the changing of this role from month to month is demonstrated. The relationship of fluctuations in the level of the Caspian and Aral Seas with a precipitation regime in their basins is investigated. Due to the unreliability of observations of winter precipitation, the levels are restored according to the course of the meridional temperature gradients. The formation of droughts occurs generally on the background of comparatively clear weather of anticyclone type, accompanied by heating of the air mass and reduction of its relative humidity. Author

N69-29691# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE CONTEMPORARY STATE AND PROSPECTS FOR DEVELOPMENT OF NUMERICAL EXPERIMENTS ON THE GENERAL CIRCULATION OF THE ATMOSPHERE AND HYDROSPHERE

L. P. Rakipova et al *In its* Mod. Prob. of Climatology 29 Nov. 1967 p 260–279 refs (See N69-29676 16-20)
Avail: CFSTI

The contents of investigations in the area of numerical experiments on general circulation of the atmosphere and hydrosphere performed in recent times are presented. The prospects for development of these investigations are discussed. The development of the theory of the overall circulation in recent time was characterized by wide application of physical–mathematical investigation methods. Author

N69-29692# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THEORETICAL PRINCIPLES OF CONSTRUCTION CLIMATOLOGY

L. Ye. Anapolskaya et al *In its* Mod. Prob. of Climatology 29 Nov. 1967 p 280–299 refs (See N69-29676 16-20)
Avail: CFSTI

The modern state and prospects for investigations on construction meteorology and climatology are analyzed. Together with an attempt at systematization of the problem of construction meteorology, certain new results are presented from works performed at the geophysical observatory. Author

N69-29693# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE CLIMATOLOGICAL ASPECTS OF INVESTIGATION OF ATMOSPHERIC CONTAMINATION WITH INDUSTRIAL WASTES

M. Ye. Berlyand *In its* Mod. Prob. of Climatology 29 Nov. 1967 p 300–315 refs (See N69-29676 16-20)
Avail: CFSTI

A discussion of problems of the consideration of climatic factors in calculating the dissipation of industrial wastes into the atmosphere is presented. Materials are analyzed from observations of atmospheric contamination over the territory of the USSR. The results of determination of meteorological characteristics aiding in the propagation of admixtures in the atmosphere are analyzed. The problem of studying the conditions of contamination of the atmosphere is particularly acute for meteorologists and climatologists. This results from the increased volume of construction, the construction of ever larger industrial and power complexes expelling tremendous quantities of harmful contaminants through ventilation and smokestacks into the atmosphere. The necessity of considering meteorological conditions of the dissipation of these contaminants from such sources is especially essential. The problem is that today's methods of purification of industrial wastes are imperfect, so that the development of indirect methods of reducing the near-ground concentrations of harmful materials is required. Author

N69-29694# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE NATURAL BACKGROUND OF ATMOSPHERIC CONTAMINATION AND THE COMPOSITION OF PRECIPITATION OVER THE TERRITORY OF THE USSR

Ye. S. Salazneva et al *In its* Mod. Prob. of Climatology 29 Nov. 1967 p 316–324 refs (See N69-29676 16-20)
Avail: CFSTI

The basic results of investigation of the chemical composition of atmospheric precipitation over the territory of the USSR are discussed. The relationship between the composition of precipitation and natural zones is clarified. The contribution of natural sources and industrial effluents to the total background level of atmospheric contamination is estimated. The tiny particles of various origins and various physical and chemical properties distributed throughout the atmosphere make up the atmospheric aerosols. Together with compounds of various gases entering the atmosphere in abundance from natural and artificial sources, these aerosols make up the background level of atmospheric contamination. It is this level which determines the number of properties of the atmosphere. Impurities in atmospheric air influence meteorological and physical-chemical processes, are the primary factors in the formation of fog, clouds, and precipitation, as well as optical and electrical phenomena. Author

N69-29695# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

AGROCLIMATIC RESOURCES OF THE USSR AND PROSPECTS FOR THEIR UTILIZATION

F. F. Davitaya *In its* Mod. Prob. of Climatology 29 Nov. 1967 p 325–337 refs (See N69-29676 16-20)
Avail: CFSTI

The state of agroclimatic investigations conducted in the USSR for purposes of forming a basis for more effective utilization of agroclimatic resources are analyzed. The prospects for utilization of agroclimatic resources for further increasing agricultural production are demonstrated. Author

N69-29696# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE INFLUENCE OF CLIMATIC FACTORS ON THE PRODUCTIVITY OF THE PLANT COVER

M. I. Budyko et al *In its* Mod. Prob. of Climatology 29 Nov. 1967 p 338–347 refs (See N69-29676 16-20)
Avail: CFSTI

The theory of photosynthesis in the plant cover is used in a study of the influence of climatic factors on the productivity of plants. Author

N69-29697# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

CLIMATIC FACTORS IN THE THERMAL STATE OF MAN

G. V. Tsitsenko *In its* Mod. Prob. of Climatology 29 Nov. 1967 p 348–358 (See N69-29676 16-20)
Avail: CFSTI

The influence of meteorological factors on the thermal state of man is analyzed, as are the results of application of a calculation method for the thermal balance of the human body for bioclimatic characteristics of the territory of the USSR. Author

N69-29698# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
MICROCLIMATIC INVESTIGATIONS AND THEIR APPLIED SIGNIFICANCE
I. A. Goltsberg *In its* Mod. Prob. of Climatology 29 Nov. 1967 p 359–373 (See N69-29676 16-20)
Avail: CFSTI

The results of investigations and geographic summarization of specifics of the microclimate of the USSR are analyzed. The application of experimental, climatological, and calculation methods allowed the value of microclimatic corrections which must be considered in studying the climate of concrete territories to be determined. Author

N69-29699# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
POSSIBILITY OF CHANGING THE CLIMATE BY ACTING ON THE POLAR ICE
M. I. Budyko *In its* Mod. Prob. of Climatology 29 Nov. 1967 p 374–387 refs (See N69-29676 16-20)
Avail: CFSTI

The relationship between the polar ice and thermal regime of the Arctic is investigated; the problem of the stability of polar ice and the possibility in principle of acting on them in order to change the climate is discussed. Author

N69-29700# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CHANGES IN THE ZONAL DISTRIBUTION OF THE ATMOSPHERIC TEMPERATURE AS A RESULT OF ACTIVE INFLUENCE ON THE CLIMATE
L. R. Rakipova *In its* Mod. Prob. of Climatology 29 Nov. 1969 p 388–421 refs (See N69-29676 16-20)
Avail: CFSTI

A more precise theory of the zonal distribution of the temperature of the atmosphere is presented. It is used as a basis for quantitative estimation of possible changes in the thermal and circulation regime of the atmosphere as a result of artificial destruction of the Arctic ice cap, as well as pollution of the upper layers of the atmosphere. Author

N69-29701# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INFLUENCING MOISTURE EXCHANGE
O. A. Drozdov Mod. Prob. of Climatology 29 Nov. 1967 p 422–432 (See N69-29676 16-20)
Avail: CFSTI

An analysis is presented on the possibility of acting on moisture exchange in order to increase the precipitation over a predetermined territory. It is shown that indirect and direct influence on and changes of moisture exchange are possible and even occur as a result of economic activity by man. It is noted that this action does not always change the moisture exchange in the desired direction. Author

N69-29702# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE POSSIBILITIES FOR INFLUENCING LARGE SCALE ATMOSPHERIC MOVEMENTS
M. I. Yudin *In its* Mod. Prob. of Climatology 29 Nov. 1967 p 433–458 refs (See N69-29676 16-20)
Avail: CFSTI

The problem of the possibilities and principles for influencing large scale atmospheric movements is analyzed on the basis of a number of conclusions from the contemporary theory of atmospheric processes and energetic considerations Author

N69-29703# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROTECTION OF PLANTS FROM FROSTS
M. E. Berlyand *In its* Mod. Prob. of Climatology 29 Nov. 1967 p 457–483 refs (See N69-29676 16-20)
Avail: CFSTI

The physical basis of methods of protecting plants from frosts by open heating, smoking and smudging, flooding and irrigation, combined and indirect action, as well as methods of predicting frosts are analyzed. The results of theoretical investigations and experimental data on the effectiveness of these methods are presented. Author

N69-29704# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INFLUENCE OF ECONOMIC ACTIVITY ON CLIMATE
M. I. Budyko et al *In its* Mod. Prob. on Climatology 29 Nov. 1967 p 484–500 refs (See N69-29676 16-20)
Avail: CFSTI

A review is presented of the influence of economic activity by man on climatic conditions; the physical methods of calculating the meteorological effectiveness of land reclamation measures are analyzed. Author

N69-29733# South Dakota School of Mines and Technology, Rapid City. Inst. of Atmospheric Sciences.
CONVECTIVE STORMS OF 1966 AND 1967 IN WESTERN NEBRASKA
D. J. Musil and A. S. Dennis Jul. 1968 32 p refs
(Grant NSF GA-789)
(REPT-68-7) Avail: Issuing Activity

Two seasons of radar observations of convective storms in western Nebraska have been analyzed with special reference to differences between hailers and non-hailers. Hailers tend to be taller than non-hailers and to have higher radar reflectivities. However, many tall storms do not produce hail at the ground, particularly those occurring late in the day or late in the season or both. No significant differences in the motions of hailers and non-hailers have been detected. About 90% of the actual hailers can be identified in real time or 15 minutes in advance with a false alarm ratio near one on the basis of synoptic and radar data entered in a linear regression equation. Use of actual hail reports provides some improvement in the separation of hailers and non-hailers. Author

N69-29743# National Weather Records Center, Asheville, N.C. Environmental Data Service.
CLIMATOLOGICAL SUMMARIES: VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET. VOLUME 1: ANCHORAGE, ALASKA INTERNATIONAL AIRPORT
Jun. 1969 33 p refs
(Contract FA-67-WAI-129)
(SRDS-RD-69-22-VOL-1) Avail: Issuing Activity

Tabular climatological data for International Airport, Anchorage, Alaska are presented for the period January 1, 1956 to December 31, 1965. Ceiling, visibility, wind, and weather information are grouped by various periods of the day and by various temperature and wind categories. Weather and landing system categories are tabulated as aids in making decisions affecting landing systems and fog dissipation at this air terminal. K.R.G.

N69-29785# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE POSSIBILITY OF FORECASTING STORMS, BASED ON UNDERWATER WAVE PRESSURE
I. I. Stas Aug. 1968 15 p refs Transl. into ENGLISH from Okeanologiya (Moscow), v. 7, no. 4, 1967 p 683–691
(AD-685477; FTD-MT-24-234-68) Avail: CFSTI CSCL 4/2

An investigation is presented of a method and equipment for the possible forecasting of storms, based on the measurement of changes in underwater pressure caused by forerunners. Underwater pressure is measured with an inductive transducer either planted on the bottom near shore or suspended from a damped wave pole. The sensor unit is comprised of two chambers, Q and M, with the former acting as the instrumentation casing and the latter consisting of a rubber cylinder contained within a perforated housing. The sensor unit has 2 measurement scales controlled from the shipboard console. The rough scale is used for recording wind-driven waves; the sensitive scale records low waves. The records obtained are compared with simultaneously taken film records. Some aspects of the nearshore implantation methods are briefly mentioned. The technique of interpreting long-wave recordings is discussed and some conclusions regarding the effectiveness of the method are drawn. Author (TAB)

N69-29881# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
REFERENCE BOOK ON THE CLIMATE OF THE USSR. ISSUE 21: KRASNOYARSK TERRITORY AND THE TUVA ASSR. Part 3: WIND, 1967
22 Nov. 1968 376 p Transl. into ENGLISH from Spravochnik Po Klimatu (SSSR), v. 3, no. 21, 1967 p 1–354
(AD-685539; FTD-MT-24-283-68) Avail: CFSTI CSCL 4/2

The book deals with wind conditions in the USSR. After some discussion of wind in relation to topography in Siberia and the Arctic, an explanation to tables of the book is given with reference made to each table. The table headings are as follows: (1) Recurrence of wind direction and calms (%); (2) Recurrence of wind direction and calms at different hours of the day; (3) Mean monthly and annual wind speed (m/s); (4) Mean monthly and annual wind speed at different hours of the day (m/s); (5) Probability of wind speed by gradations (in % of the total number of cases); (6) Probability of wind speed by gradations at different hours of the day (%); (7) Probability of wind by gradation of speeds and with respect to directions at different hours of the day (%); (8) Probability of wind of different speed with respect to directions; (9) Mean numbers of days with high wind; (10) Greatest wind speeds (m/s) of different probability; (11) Diurnal variation of wind speed (m/s); (12) Diurnal variation of wind direction and calms (%). Author (TAB)

N69-29910# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ELECTRICITY OF THE FREE ATMOSPHERE (RESULTS OF MEASUREMENTS DURING THE IGY AND MGC)
I. M. Imyanitov et al 21 Aug. 1968 276 p refs Transl. into ENGLISH of the Book "Elektrichestvo Svobodnoy Atmosfery (Rezultaty Uzmeremiy Vo Vremya MGG I MGC)" Leningrad, Gidrometeorol. Izd., 1965 p 1–240

The book is based on data obtained during the IGY by systematic aircraft soundings of the earths electric field. More than 2000 soundings were made, and the results of data processing are analyzed in the book. In addition to the detailed information on the initial data presented in tabular form, the book gives, for the first time, pertinent information on the structure of the electric field in good weather, on the distribution of volumetric electric charges and potentials under these conditions. Also included are data on the electric structure of stratified clouds. Thus, the book presents a general picture of the electric structure of the atmosphere on cloudy and clear days. It is intended for specialists in the field of atmospheric, as well as the specialists in all those fields which are concerned with the phenomena of atmospheric electricity. Author (TAB)

N69-29917# National Weather Records Center, Asheville, N.C.
CLIMATOLOGICAL SUMMARIES. VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET. VOLUME 2: ATLANTA AIRPORT, ATLANTA, GEORGIA Final Report
Jun. 1969 31 p
(Contract FA-67-WAI-129)
(SRDS-RD-69-22-Vol-2) Avail: Issuing Activity

Tabulated data are presented on visibilities and ceilings versus intervals of duration; categories of aircraft landing operations versus intervals of duration; wind direction versus speed by percentage frequency; and categories of aircraft landing operations versus intervals of duration. The climatological survey is to be used for the Atlanta Airport, Atlanta, Georgia. The ceiling, visibility, wind, and weather information are grouped by various periods of the day and by various temperature and wind categories. Various weather and landing system categories are tabulated, in most cases from 10 years of data, as aids for making decisions affecting landing systems and for dissipation at the air terminals. B.P.

N69-29918# National Weather Records Center, Asheville, N.C.
CLIMATOLOGICAL SUMMARIES. VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET. VOLUME 4: INTERNATIONAL AIRPORT, BIRMINGHAM, ALABAMA Final Report
Jun. 1969 31 p
(Contract FA-67-WAI-129)
(SRDS-RD-69-22-Vol-4) Avail: Issuing Activity

For abstract see N69-29917. Data in this case is for the International Airport, Birmingham, Alabama.

N69-29946# National Weather Records Center, Asheville, N.C.
CLIMATOLOGICAL SUMMARIES. VISIBILITIES BELOW 1/2 MILE AND CEILINGS BELOW 200 FEET. VOLUME 3: FRIENDSHIP INTERNATIONAL AIRPORT, BALTIMORE, MARYLAND Final Report
Jun. 1969 31 p
(SRDS-RD-69-22-Vol.-3) Avail: Issuing Activity

For abstract see N69-29917. Data in this case is for the Friendship International Airport, Baltimore, Maryland.

N69-29950# National Weather Records Center, Asheville, N.C.
INSTRUCTIONS FOR COMPLETING HIGH ATTITUDE METEOROLOGICAL DATA FORMS AND DETAILS OF THE PUBLICATION FORMAT
Jan. 1969 38 p
Avail: Issuing Activity

A manual is presented as an aid to scientists for submitting data in the prescribed form for publication. The instructions are divided into three sections: (1) general information about the two ways that the data can be submitted (magnetic tapes and reduced manual form), (2) identification of the station, date, and sensor data, and (3) instructions for the different forms of meteorological data. Code tables for sensor information and the details for the publication format are presented. Letters endorsing the new format, high altitude meteorological data forms, and publication format model are included. J.A.M.

N69-29974# Danish Meteorological Inst., Charlottenlund.
METEOROLOGICAL YEARBOOK, 1956. SECOND PART: GREENLAND [METEOROLOGISK ARBOG. 2den DEL: GROENLAND]
1968 52 p In DANISH and FRENCH
Avail: CFSTI

Meteorological data obtained at 16 stations in Greenland on the 8th, 14th, and 21st day of each month of the year are presented as well as monthly summaries and averages of some of these stations. The data include air pressure and temperature, vapor pressure, relative humidity, wind direction and velocity, visibility, and precipitation. Transl. by K.W.

N69-30028# Army Electronics Command, Fort Huachuca, Ariz. Atmospheric Sciences Lab.
ANALYSIS OF WIND DATA FROM A SOUTH CAROLINA COASTAL FOREST
H. Shinn Feb. 1969 32 p refs
(AD-684921, E(IOM-6036) Avail: CFSTI CSCL 4/2

The report summarizes the mean wind and turbulence characteristics in and above a jungle-like South Carolina coastal forest. The vegetation was black gum-red maple. Data on leaf area density estimates as well as stem densities are tabulated. The mean vector wind had two notable features: a nearly constant speed in the lowest two-thirds of the canopy, and a turning of wind direction with height in the same layer. All three components of the turbulence intensity were larger below the canopy, especially the longitudinal component. Variance spectra of the vector wind speed indicated that an inertial subrange existed at all heights above and below the canopy, and that as far as could be determined the energy dissipation rate was nearly constant with height. Author (TAB)

N69-30037# Joint Publications Research Service, Washington, D.C.
EFFECTS OF SEVERE ATMOSPHERIC CONDITIONS ON AIRCRAFT
A. Smolin 18 Jun. 1969 7 p Transl. into ENGLISH from Aviats. i Kosmonavt. (Moscow), no. 5, 1969 p 30-31
(JPRS-48257) Avail: CFSTI

The atmospheric conditions which cause the formation of a thunderstorm cloud, as well the stages of development, are discussed and graphically illustrated as related to the danger posed to an aircraft and its crew. The three stages in the formation of such clouds are: (1) initial development of a cumulus cloud; (2) its maturity; and (3) the dissipation stage. It is emphasized that the principal cause for the formation of an electric potential is the falling of precipitation and the resulting charge separation of a water droplet during fragmentation. Observations indicate that in a violent thunderstorm there are 10 to 20 lightning discharges per second, although the number of recorded cases of direct impact is extremely small (less than 2 percent). It is concluded that rain erosion and hail constitute the greatest danger to aircraft, and possible methods of combating the structural damage are briefly treated. A.C.R.

N69-30079# North Dakota State Univ., Fargo. Agricultural Engineering Dept.
RADAR AND HAILFALL OBSERVATIONS OF HAILSTORMS IN SOUTHWESTERN NORTH DAKOTA DURING 1967
A. F. Butchbaker Feb. 1969 51 p refs
(Grants NSF GP-5485, NSF GA-857)
Avail: Issuing Activity

This is a report on the hailfall and radar climatology of seeded and unseeded thunderstorms in the vicinity of the Bowman-Slope Hail Suppression Association's cloud seeding program during the summer of 1967. Approximately 2,880 grams of silver iodide per storm were dispensed by wingtip generators and pyrotechnic flares. Nineteen storm systems were seeded on 16 days with no hail occurring on 7 days and hailfall recorded on 9 days. On 6 of the 9 hailfall days a suppressive effect was observed. Radar reflectivity decreased significantly after seeding. The target area had significantly less hailfall energy, measured by hailpad indicators, than the south and southwest control areas, but more hailfall energy than areas to the north and northeast. There were no statistical differences in the seasonal precipitation between the seeded area and unseeded areas to the west, southwest, south, and northeast of the target area. Author

N69-30093# Pennsylvania State Univ., Univ. Park. Dept. of Meteorology.
A NUMERICAL MODEL OF CUMULUS DYNAMICS AND MICROPHYSICS
Alan I. Weinstein Jan. 1969 84 p refs
(Grant NSF GA-3956)
(Rept-13) Avail: Issuing Activity

The evolution of a cumulus cloud, a complicated phenomenon resulting from the interaction of numerous subphenomena, can be best understood by simulating the subprocesses on a computer or in the laboratory. A numerical model was developed to explore the interaction between the thermodynamics, dynamics, and microphysics of cumulus clouds, and to investigate the roles of evaporation, freezing, and precipitation development of these clouds in their growth. The model can be used in basic research to gain some insight into the interactions of the various processes taking place in cumuli; in applied research to suggest improved cloud modification procedures; and in the field to guide daily operations. Author

N69-30094# National Environmental Satellite Center, Washington, D.C.
ESTIMATING MAXIMUM WIND SPEED OF TROPICAL STORMS FROM HIGH RESOLUTION INFRARED DATA
L. F. Hubert, A. Timchalk, and S. Fritz May 1969 38 p refs
(NESC-50) Avail: CFSTI

Cloud patterns produced by tropical storms can be mapped from infrared radiation data. An empirical relationship between pattern measurements from Nimbus 2 high resolution infrared (HRIR) data and storm's maximum wind speed (MWS) was derived. Two mean radii are related to MWS: the overall canopy size (r_o) and an inner radius (r_i) associated with the storm's eye. The highest correlation is between MWS and the quantity $[r_o/r_i]^q$. From the sample the best fit was for $q = 1.4$, but the correlation was equally significant for any value of q between 0.5 and 2.0. Theory suggests there may be physical significance in $q = 0.5$, but the small sample used here prevents any such interpretation. The study indicates there may be useful MWS information in the HRIR pattern measurements. Author

N69-30096# National Environmental Satellite Center, Washington, D.C.
SOME ASPECTS OF THE VORTICITY STRUCTURE ASSOCIATED WITH EXTRATROPICAL CLOUD SYSTEMS
Harold J. Brodrick, Jr. May 1969 12 p
(NESCTM-16) Avail: CFSTI

Results are presented showing a relationship between stages of satellite-observed cloud-pattern development in extratropical cyclones and the associated 1,000-500-mb layer-mean vorticity maxima. The vorticity maxima increase in magnitude in the early stages to reach the highest values in the mature stage of cloud pattern development, and their locations are essentially coincident with the center of cloud pattern organization throughout the development. Author

N69-30135# North Dakota State Univ., Fargo. Dept. of Agricultural Engineering.
RADAR AND HAILFALL OBSERVATIONS OF HAILSTORMS IN SOUTHWESTERN NORTH DAKOTA DURING 1968
A. F. Butchbaker May 1969 58 p refs
(Grants NSF GP-5485; NSF GA-857)
Avail: Issuing Activity

During the summer of 1968 storms were seeded in southwestern North Dakota with 96,000 grams of silver iodide for hail suppression with wingtip generators and pyrotechnic devices. There were 31 storms seeded in 27 days. Of 16 seeded cases, 7 cases exhibited hailfall or radar reflectivity changes and 9 cases exhibited little change or erratic results. Of the seven cases, there were zero increases and seven decreases in hail intensity after seeding. There were eight seeded days with no hail observed. The radar reflectivities and cloud top heights were significantly different between hailers and non-hailers. A regression analysis indicated very small correlation between storm velocities and time of day or day from 1 June. Early season storms tended to travel from the southwest and late season storms from the northwest. The seasonal hail energy indicated that the seeded area had significantly less hailfall energy than the south, southwest, and west unseeded areas. There were no significant differences in seasonal hail energy between the seeded area and unseeded areas to the east and northeast; and no significant differences in seasonal precipitation between the seeded area and the unseeded south, southwest, and west areas. Author

N69-30143# Environmental Science Services Administration, Atlantic City, N. J. Test and Evaluation Lab.
ANALYSIS OF DESIGN CHARACTERISTICS OF METEOROLOGICAL TOWER FACILITY Final Report
Frederick C. Hochreiter Jan. 1968 100 p refs
(Contract FA-65-WAI-96)
(AD-684864) Avail: CFSTI CSCL 4/2

An analysis of design characteristics for an aviation oriented meteorological tower facility is discussed. The feasibility of converting an existing 160 ft. Air Height Surveillance Radar Tower is investigated. The study also incorporates an analysis of the instrumentation required to adequately describe the desired parameters, as well as sensor characteristics, spacing, orientation, and configuration, and the cost of such instrumentation. The feasibility of using the laser and aerosol measuring devices in the tower facility is discussed. Conclusions support the establishment of the Meteorological Tower test bed with a capability for measuring all parameters of interest to aviation terminal operations. The mass of the Tower gives it the stability necessary to affix components of transmissometer systems that will aid in slant visibility studies. Author (TAB)

N69-30145# Travelers Research Center, Inc., Hartford, Conn.
RESEARCH ON THE THEORY OF CLIMATE. VOLUME 1 Final Report
Barry Saltzman May 1968 72 p refs
(Contract E22-137-67(N))
(PB-180153; TRC-7047-312A) Avail: CFSTI CSCL 04B

Results are presented of two separate studies. The first deals with solutions of the quasi-geostrophic perturbation equations governing the forced response of the atmosphere to the zonally-asymmetric field of heating. The second study deals with the problem of parameterizing the meridional transport of relative angular momentum by transient eddies. Author (USGRDR)

N69-30153# National Science Foundation, Washington, D.C.
WEATHER MODIFICATION Annual Report for Fiscal Year ended 30 Jun. 1967
Jun. 1967 104 p
(NSF-68-21) Avail: SOD $.40

National efforts during the fiscal year 1967 toward developing a weather modification capability and the use of available money and manpower for optimum effectiveness are summarized. Federal activities and a few foreign projects are described according to specific types of modification so that the total national involvement in each area can be readily determined. Topics include: (1) modification of precipitation characteristics; (2) hail suppression; (3) fog dissipation; (4) cloud electricity, lightning, and severe storm analysis; and (5) development of small scale mathematical models of atmospheric processes and large scale models of climate modification. In addition, the social, economic, legal, and ecological aspects of weather modification are discussed. A.C.R.

N69-30264# Pennsylvania State Univ., University Park. Dept. of Meteorology.
A PARAMETERIZED NUMERICAL MODEL OF CUMULUS CONVECTION
A. I. Weinstein and L. G. Davis May 1968 75 p refs Revised
(Grant NSF GA-777)
(Rept-11) Avail: Issuing Activity

A numerical model combining the accuracy of detailed calculations where the mechanisms are well understood, with the speed of parameterization where the phenomena are complex, has been produced for use as a research and/or field operations tool. Its calculations utilize entrainment principles along with cloud microphysics relationships in order to yield steady state, Lagrangian, profiles of vertical velocity, temperature, liquid water content, and radar reflectivity factor in the core of an isolated cumulus cloud. The calculations also yield total rainfall and duration of rainfall at cloud base and total updraft area in the cloud layer. Results of model calculations are presented along with suggestions of application of the model in several fields of cloud physics and dynamics. The model's speed and versatility make it potentially powerful as both a research and operational tool. Author

N69-30286# International Antarctic Meteorological Research Centre, Melbourne (Australia).
SATELLITE STUDIES OF CYCLONIC DEVELOPMENTS OVER THE SOUTHERN OCEAN
D. W. Martin Apr. 1968 72 p refs
(TR-9) Avail: CFSTI

A technique has been devised for inferring vertical profiles of temperature, moisture, and wind from cloud patterns in satellite photographs of the Southern Ocean area. The technique is based on a cloud classification scheme which describes the most frequent and synoptically important large and small scale cloud patterns according to their geometry, texture, brightness, and position relative to other patterns. Winter season (1966) soundings from Macquarie and Campbell Islands were used to construct mean profiles of temperature, moisture, and wind for as many patterns as possible. These mean profiles show subtantial systematic differences, yet scatter among individual soundings for the same pattern is generally small. The primary aim of this scheme is to supplement conventional data in a study of Southern Ocean cyclones by filling gaps between scattered island and coastal stations. Its usefulness is demonstrated in a series of surface analyses of an active frontal band passing to the south of Australia. Author

N69-30305# Danish Meteorological Inst., Charlottenlund.
RUDE SKOV GEOPHYSICAL OBSERVATORY: MAGNETIC RESULTS, 1966
1969 66 p
Avail: CFSTI

Standard observations for the year 1966 are presented in tabular form. Four types of tables are included with data on: (1) hourly means of the horizontal component of magnetic intensity; (2) hourly means of magnetic declination; (3) hourly means of the vertical component of magnetic intensity; and (4) extreme values of magnetic elements. A.C.R.

N69-30323# Environmental Technical Applications Center (Air Force), Washington, D. C.
US NAVAL WEATHER SERVICE WORLD-WIDE AIRFIELD SUMMARIES. VOLUME 9, PART 2: AFRICA (SOUTHERN HALF)

Feb. 1969 613 p refs
(AD-682915) Avail: CFSTI CSCL 4/2

This volume provides climatological summaries for airfields and climatic areas in Africa (Southern Half). Climatic areas have been selected as being nearly homogeneous climatologically, but considerable variation may exist between locations in an area at a specific time because of topography and other factors. TAB

N69-30353# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE QUESTION OF OPTIMUM FREQUENCY AND ACCURACY OF METEOROLOGICAL MEASUREMENTS
A. V. Sadovnikov 3 Dec. 1968 11 p refs Transl. into ENGLISH from Tr. Arkticheskogo i Antarkt. Nauchno-Issled. Inst. (Leningrad), v. 281, 1967 p 82–85
(AD-685019; FTD-HT-23-1043-68) Avail: CFSTI CSCL 4/2

The author presents a new approach to the optimal organization of a system of meteorological observations in order to attain optimum frequency and accuracy of observations. The disturbances in the meteorological fields regardless of their nature are considered as individual configurations which can be characterized by geometrical dimensions. Author (TAB)

N69-30361# North Dakota State Univ., Fargo. Agricultural Engineering Dept.
HAILSTORM CHARACTERISTICS IN THE VICINITY OF A HAIL SUPPRESSION PROJECT IN SOUTHWESTERN NORTH DAKOTA DURING 1966, 1967, AND 1968
A. F. Butchbaker June 1969 23 p refs
(Grants NSF GP-5485; NSF GA-857)
Avail: Issuing Activity

This report presents a three year summary (1966-1968) of the hailstorm characteristics in southwestern North Dakota. Based upon a prediction equation from a multiple linear regression analysis with 1968 synoptic and radar input data, 80 percent of the hailers could be predicted with only five percent of the non-hailers being accepted as hailers. The results of this investigation suggest that the cloud seeding program reduced hail intensity by 30 to 60 percent in the target area, compared with hail intensities in the south and west unseeded control areas, without significantly changing the precipitation in the seeded or unseeded areas. The radar reflectivities and cloud top heights were significantly higher before seeding than after seeding. Based upon the three years of data, the probability for a hail intensity increase after seeding was less than 0.04. Approximately two-thirds of the seeded storms had decreasing hail intensity or no hailfall after seeding; the remaining one-third had either erratic pulsating changes or no change after seeding. These results suggest that hailfall was either suppressed or eliminated by the cloud seeding program on two-thirds of the potential hailstorms. Precipitation was not significantly affected in the seeded or adjacent unseeded areas. Author

N69-30369# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
APPROXIMATE CALCULATION OF PROBABILITIES OF ATMOSPHERIC WATER-VAPOR DENSITY
R. A. Pershina 11 Jul. 1968 7 p refs Transl. into ENGLISH from Tr. Nauchn.-Issled. Inst. Aeroklimatologii (Moscow), no. 37, 1966 p 90–92
(AD-685149; FTD-HT-23-461-68) Avail: CFSTI CSCL 4/2

Approximate estimates of the integral probabilities of atmospheric water-vapor densities of (in g/cu m) were obtained from data in tables of hourly observations at 30 airports in the USSR from 1954 through 1958. Since the information on humidity contained in these tables was not given in terms of the vapor pressure, but in dew points, water-vapor density was determined from dew points and air temperatures. The probabilities of water-vapor densities were calculated for each station on punched-card machinery. Author (TAB)

N69-30381# Pennsylvania State Univ., University Park. Dept. of Meteorology
A DIGITAL TELEMETRY SYSTEM FOR WEATHER MODIFICATION RESEARCH Progress Report
Neil D. Kelley May 1969 130 p refs
(Grant NSF GA-3958)
(Rept-14; PR-4) Avail: Issuing Activity

The system requirements imposed by physical and statistical evaluations of weather modification field data, the volume of data to be handled, data processing and display, and operational and environmental system requirements were reviewed. Four types of telemetry modulations were evaluated; frequency modulation (FM), pulse-amplitude modulation (PAM), pulse-duration modulation (PDM), and pulse-code modulation (PCM) as transmitted over a frequency modulated radio link. Special consideration was given to the following characteristics: accuracy, interference susceptability, degree of flexibility, efficiency, complexity, interface ability, and data storage and processing. It is concluded that the PCM technique is best for weather modification research. Author

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N69-29084 Pennsylvania Univ., Philadelphia.
AN ANALYSIS OF ADVANCED NAVIGATION SATELLITE CONCEPTS
Perry Ian Klein (Ph.D. Thesis) 1968 134 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 69-132

An L-band synchronous navigation satellite concept, based on the use of a short-baseline radiating satellite interferometer to provide aircraft and ships with angular position fixes accurate to within one nautical mile, is described. A simple method of modulating the navigation signals radiated from the satellite interferometer is used to permit the use of relatively simple navigation receiving equipment. The navigation signals are compatible with existing aircraft VHF communications equipment, with the addition of an L-band antenna, converter, and post-detection signal processing circuits. The result is a partial integration of the navigation and communications functions and a consequent reduction in user equipment costs. A method of using the navigation satellite simultaneously with both active and passive users is suggested. The approach is intended to retain the desirable characteristics of both types of user systems, while providing the surveillance and communications functions needed for efficient traffic control. It is shown that the primary limitations on system accuracy are those due to tropospheric phase fluctuations, multipath effects, and interferometer antenna phase pattern mismatch. Several methods of reducing these errors are described, as well as a summary of the advantages offered over other navigational techniques. Dissert. Abstr.

N69-29128 Pennsylvania Univ., Philadelphia.
STRAPDOWN INERTIAL NAVIGATION
Itzhack Yoev Bar-Itzhack (Ph.D. Thesis) 1968 150 p
Avail: Univ. Microfilms: HC $7.00/Microfilm $3.00 Order No. 69-62

This dissertation treats the problem of reducing the errors in the determination of the vehicular attitude, the major source of inaccuracy in a strapdown inertial navigation system. There are two sources of attitude error: the sensor error, which is an error in the measured angular information, and the computational error, which

is the result of an inaccurate computation of the direction cosine matrix. Methods to reduce the two error sources are studied in this dissertation. A way to eliminate gyro drift error due to output axis angular acceleration is examined. In order to reduce the computational errors, various computational schemes are analyzed. It is concluded that the use of quaternions to determine the orientation of the vehicle is a most efficient method.
Dissert. Abstr.

N69-29371*# Massachusetts Inst. of Tech., Cambridge. Instrumentation Lab.
CONTROL, GUIDANCE, AND NAVIGATION FOR ADVANCED MANNED MISSIONS. VOLUME 4: INERTIAL SUBSYSTEMS Final Report
Sep. 1968 265 p refs
(Contract NAS9-6823)
(NASA-CR-99678; R-600-Vol-4) Avail: CFSTI CSCL 17G

The application and evaluation of strapdown inertial systems was studied, and mission analyses were conducted for both transplanetary and entry phases using a strapdown system error mechanization. The corresponding performance of inertial components and software parameters was defined. An in-depth analysis and test evaluations were performed to determine the capabilities and limitations of strapdown inertial configurations. Studies of instrument dynamic error sources, torque-to-balance loop techniques, and attitude algorithms were conducted, and state-of-the-art inertial instruments were evaluated. A gyro package was developed with supporting test facilities, including a real-time computational algorithm. Test evaluations were programmed to determine the potential of the strapdown configuration.
K.W.

N69-29686*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LOW-SPEED DEPLOYMENT, INFLATION, AND STEADY-DESCENT CHARACTERISTICS OF RAM-AIR-INFLATED BALLOON RECOVERY SYSTEMS WITH PERIPHERAL AIRSCOOP
Sanger M. Burk, Jr. Washington Jun. 1969 24 p refs Film supplement number L-1048 to this report is available on loan from NASA, Langley Research Center, Langley Station, Va.
(NASA-TN-D-5186) Avail: CFSTI CSCL 01A

A free-flight investigation at low subsonic speeds has been conducted in a 20-foot vertical tunnel on several 6.0-foot-diameter ram-air-inflated balloons with various numbers and locations of peripheral airscoops to determine the deployment, inflation, and steady-descent characteristics of this type of recovery system. The configurations consisted of balloons constructed with 8, 12, and 24 gores with airscoops in each gore. Some of the balloons also were equipped with an open throat to provide additional inlet area. The results of the investigation indicated that the altitude loss during deployment and inflation, and the inflation time of the balloon decreased as the total airscoop area of the balloons increased. The balloons however reached their final drag coefficient and rate of descent considerably before they became completely inflated; and in some instances, balloons with a smaller airscoop area achieved their final drag coefficient and finaly steady-state rate of descent with less altitude loss than balloons with a greater airscoop area. Location of the airscoops higher on the balloon, up to a point somewhat above the maximum diameter, produced a more rapid inflation and less altitude loss. Also, the use of an open throat together with peripheral airscoops increased the balloon inflation rate somewhat and reduced the altitude loss.
Author

N69-29783*# Aztec School of Languages, Inc., Maynard, Mass. Research Translation Div.
AIRCRAFT NOISE ABATEMENT [GELUIDHINDER DOOR VLIEGTUIGEN]
C. W. Kosten Washington NASA Jun. 1969 80 p refs Transl. into ENGLISH from Rept. of the Advisory Comm. on Aircraft Noise Abatement (Delft), Jun. 1967 p 125
(Contract NASw-1692)
(NASA-T-F-12093) Avail: CFSTI CSCL 17G

Chosen is a maximum noise limit wherein the permissible limit is exceeded for only about 1/3 of the residents of the area, even though this still represents a rather large percentage of the population. This maximum noise limit is a mathematical factor which can be determined from: (1) the annual number of aircraft flying over a given area; (2) the noise caused by each of these aircraft in a given residential area; and (3) the time each of these aircraft is involved, since night traffic causes more annoyance than day traffic. Exceeding the limit can be prevented by: equipping the aircraft with noise-abatement devices; assuring that there is sufficient distance between the residential area and the airfield; cutting down on air traffic over residential areas; maintaining a flight schedule by which less noise is produced in a given residential area; and reducing the number of flights during high-annoyance times of the day.
Author

N69-29797# Federal Aviation Administration, Atlantic City, N.J. National Aviation Facilities Experimental Center.
AN EVALUATION OF THE VOR/DME OMNITRAC 1 A AREA NAVIGATION SYSTEM Final Report
Bernhart V. Dinerman Jun. 1969 136 p
(FAA-69-29; RD-69-30) Avail: CFSTI

Laboratory and flight tests of an area navigation system designated as the VOR/DME Omnitrac 1A were performed at the National Aviation Facilities Experimental Center (NAFEC), Atlantic City, New Jersey, and in the air traffic control environment. The flight tests in a Federal Aviation Administration Gulfstream aircraft (N-376) were divided into operational tests between Washington, D.C., and Atlanta, Georgia, and engineering tests between Atlantic City, New Jersey, and Washington, D.C. Subjective and engineering data were obtained. Based on the evaluation of the data collected, it was determined that: (1) Enroute area navigation accuracies were within present airway widths. (2) Flight technical error was the major contributing factor to the total navigation error. (3) The total electronics navigation error, which included the error contribution of the Omnitrac, was small in comparison to the flight technical and total navigation errors. (4) Navigation with the Omnitrac was preferred by the subject pilots over conventional navigation due to the increased operational options associated with area navigation. (5) Control of an aircraft equipped with area navigation equipment minimizes the need for radar vectoring, permits direct and parallel routings, and reduces the communication workload.
Author

N69-29862# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF DRY FRICTION ON THE MOTION OF A GYROSCOPE WITH FORCED ROTATION OF THE CARDAN SUSPENSION
V. A. Yablonskaya Aug. 1968 10 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Priborostr. (Leningrad), v. 10, no. 9, 1967 p 80–83
(AD-684999; FTD-HT-23-448-68) Avail: CFSTI CSCL 17/7

The article discusses the influence of dry friction on the motion of an unbalanced gyroscope with forced rotation of the Cardan suspension. It is shown that in the first approximation such a gyroscope, in contrast to the ordinary one, does not have systematic errors and the nutational oscillations of its axis are damped.
Author (TAB)

N69-29913# Air Force Missile Development Center, Holloman AFB, N. Mex.
THE APPARENT INPUT AXIS MISALIGNMENT ERROR CAUSED BY ANGULAR ROTATION ABOUT THE OUTPUT AXIS OF A SINGLE-DEGREE-OF-FREEDOM, RATE-INTEGRATING GYRO
Bud J. Wimber Mar. 1969 28 p
(AD-685211; MDC-TR-69-2) Avail: CFSTI CSCL 17/7

Results of laboratory testing of inertial grade strapdown single-degree-of-freedom gyroscopes has revealed that a deterministic error, proportional to rate squared, is generated when the gyro is subjected to angular rates about the output axis (OA). Tests further indicate that the rate error is related in some way to OA friction effects. This is evident from tests conducted on gyros where an attempt was made to reduce the OA friction coefficient by use of dithering jewel and taut wire suspension. Additional laboratory tests are being conducted in order to identify the exact source of the error. Author (TAB)

N69-29967*# Stanford Univ., Calif.
ANALYSIS OF OSCILLATIONS IN PULSE-MODULATED SATELLITE ATTITUDE CONTROL SYSTEMS
Robert Newhall Clark Washington NASA Jul. 1969 108 p refs
(Grant NGR-05-020-007)
(NASA-CR-1369; SUDAAR-361) Avail: CFSTI CSCL 22B

This study reveals the relationship between the physical parameters and the principal limit cycle oscillation of a pulse-modulated feedback system of the type used for attitude control in satellites. The pulse actuation used in this sytem implies there will be a limit cycle oscillation about the equilibrium point. A two-pulse limit cycle is the most efficient and most accurate one possible. Tn integral-pulse-frequency modulator is established as having the requisite steady-state dynamic characteristics for the existence of the two-pulse limit cycle. The stability of the limit cycle is then determined from a transient analysis of the system, using a method based on the geometrical properties of the state transition equations. Previously, stability analysis of this nature has been approached using Lyapunov-like methods or conventional frequency domain techniques. The conditions under which four-pulse, six-pulse, and higher order limit cycle oscillations can occur are also determined, and their existence is verified experimentally, using digital simulation. Author

N69-30003*# TRW Systems Group, Redondo Beach, Calif.
NAVIGATION/TRAFFIC CONTROL SATELLITE MISSION STUDY. VOLUME 1: SUMMARY
J. H. Craigie et al Jun. 1969 45 p refs
(Contract NAS12-595)
(NASA-CR-86166; TRW-09778-6008-R0-00) Avail: CFSTI CSCL 17G

A synthesis of a system composed of satellites, ground stations, and hardware in various user craft which provides transoceanic traffic control as well as a wide variety of operational support services for aviation and marine craft is discussed. This navigation traffic control satellite system employs a number of multipurpose satellites that provide passive navigation capabilities to any and all users; voice and data communications to aviation and marine subscribers; automatic data reporting for air traffic control surveillance; and a growth capability to collision avoidance and stationkeeping. The high performance attainable with the recommended all L-band system will provide operational flexibility and growth potential. There are no real deficiencies in technology as was considered likely at the outset of this study. The status of L-band technology today is such that the design, development, and demonstration program can be initiated immediately. The design and development preoperational program recommended for the development and demonstration of the basic satellite configuration and ground stations, is estimated to cost $67 million. Author

N69-30004*# TRW Systems Group, Redondo Beach, Calif.
NAVIGATION/TRAFFIC CONTROL SATELLITE MISSION STUDY. VOLUME 2: SYSTEMS ANALYSES
J. H. Craigie, A. W. Dobieski, H. G. Raymond, P. R. Schultz, L. J. Mitchler et al Jun. 1969 380 p refs
(Contract NAS12-595)
(NASA-CR-86167; TRW-09778-6009-R0-00) Avail: CFSTI CSCL 17G

The nature supporting analyses that explain the selection and design of the navigation/traffic control satellite system are presented. In arriving at the recommended configuration, conceptual configurations of a number of promising candidate systems were developed. The selection process and the reasoning that was used to select the most promising candidate configurations are reported. This includes the development of requirements and criteria, the communications load analysis, the communications subsystem analysis, a position determination subsystems analysis, and a spacecraft design analysis. Author

N69-30005*# TRW Systems Group, Redondo Beach, Calif.
NAVIGATION/TRAFFIC CONTROL SATELLITE MISSION STUDY. VOLUME 3: SYSTEM CONCEPTS
J. H. Craigie, A. F. Caprioglio, C. W. Renn, A. N. Drucker, K. M. Pierce et al Jun. 1969 301 p refs
(Contract NAS12-595)
(NASA-CR-86168; TRW-09778-6010-R0-00) Avail: CFSTI CSCL 17G

The navigation/traffic control satellite system concept and the basic design and test philosophy are outlined. The recommended North Atlantic operational system is described and details are given on spacecraft, user hardware, and ground stations. The design and development/preoperational system which is needed in order to develop and demonstrate the hardware, software, and operational aspects is presented. Author

N69-30193# Massachusetts Univ., Amherst. School of Engineering.
A STATISTICAL ERROR ANALYSIS OF THE GYROCOMPASS
Mark E. Kimball and C. E. Hutchinson Mar. 1969 74 p refs
(Contract N00014-68-A-0146; Proj. Themis)
(AD-684843; THEMIS-UM-69-3) Avail: CFSTI CSCL 17/7

The accuracy of a gyrocompass is dependent not only upon the sophistication of its components, but also upon the response of the system to both random and deterministic inputs. It is on the basis of the above concept that this report develops a gyrocompass system model and a method by which a statistical analysis may be performed on this and other gyrocompass systems. The results indicate what sort of output should be expected for various input conditions. Conclusions are drawn with regard to dominant sources of error, and recommendations are made concerning further research which is necessary in this particular area. Author (TAB)

N69-30219# Matrix Corp., Alexandria, Va.
ELECTRONIC AND OPTICALLY GENERATED AIRCRAFT DISPLAYS: STUDY OF STANDARDIZATION REQUIREMENTS
James M. Ketchel and Larry L. Jenney May 1968 435 p refs
(Contract N00014-67-C-0517)
(AD-684849; JANAIR-680503) Avail: CFSTI CSCL 17/7

This study reviewed and analyzed the research literature relating to electronically and optically generated aircraft displays. The purpose was to provide background information to support standardization of such displays for military aircraft. The scope of the inquiry was limited to vertical and horizontal situation displays, either of the direct view or projected (head-up) type, used by the pilot for aircraft and mission control. The results have been set forth under three major headings: Information requirements, a

synthesis of 18 system studies and 11 current display designs to determine the basic information content necessary for general flight and certain special missions. Symbology - an evaluation of research findings dealing with static and dynamic symbol characteristics and display format, and Display characteristics - a delineation of optimum visual characteristics of displays in relation to the conditions of use and the techniques of image generation. The report also contains an extensive bibliography and specific recommendations for additional research. Author (TAB)

N69-30268# Federal Aviation Administration, Washington, D. C.
AIR TRAFFIC AND AIRPORT CONGESTION: SELECTED REFERENCES
Mar. 1969 45 p refs *Its* Bibliographic List 17
(AD-685609) Avail: CFSTI CSCL 1/2

The document contains a selected, partially annotated listing of journal articles, newspaper articles, papers and technical reports on the subject of congestion - in the air, on the ground and at the terminal building. Author (TAB)

N69-30299# Deutsche Versuchsanstalt fuer Luft- und Raumfahrt, Oberpfaffenhofen (West Germany). Inst. fuer Steuer- und Regeltechnik.
GENERAL ERROR ANALYSIS FOR A TRIAXIALLY STABILIZED INERTIAL PLATFORM [ALLGEMEINE FEHLERANALYSE FUER EINE DREIACHSIG STABILISIERTE TRAEGHEITSPLATTFORM]
K. Reinel Dec. 1968 68 p refs In GERMAN; ENGLISH summary
(DLR-FB-68-78; DVL-766) Avail: CFSTI

A general error equation valid in all reference systems is stated for a three axes stabilized inertial platform. The differential equations, with time variable coefficients, are simulated on an analog computer for a given geocentric reference system. Component error and platform orientation errors were considered as error sources. Time dependent position deviations in north-south and east-west directions are registered for each individual error source. Author (ESRO)

N69-30316# Environmental Science Services Administration, Washington, D.C.
CLIMATOLOGICAL DATA FOR ANTARCTIC STATIONS, NUMBER 9, JANUARY–DECEMBER 1966
Jan. 1968 212 p
Avail: Issuing Activity

Surface weather observations recorded for 3-hourly intervals for Amundsen–Scott, and Byrd weather stations are tabulated. Monthly precipitation amounts are included when available from observation records. Peak wind gusts were recorded for all stations. Rawinsonde and surface data for USNS Eltanin are included. Surface temperature extremes and averages have been computed. F.O.S.

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N69-29040# Oak Ridge National Lab., Tenn. Nuclear Safety Information Center.
FISSION PRODUCT RELEASE AND TRANSPORT IN LIQUID METAL FAST BREEDER REACTORS
G. W. Keilholtz and G. C. Battle, Jr. Mar. 1969 152 p refs (Contract W-7405-eng-26)
(ORNL-NSIC-37) Avail: CFSTI

A state-of-the-art review of fission product behavior in liquid metal systems is presented. Topics discussed include: fuels and fuel elements for fast reactors; fission product release from reactor fuel; fission product retention in and release from liquid Na systems; Na fires in reactor containment systems; fission product transport and sodium oxide aerosols; sampling, characterization, and filtration of Na fission product aerosols; and experience with reactor designs, fuel meltdowns, and fission product release. NSA

N69-29108# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Reaktorentwicklung.
A METHOD FOR CALCULATING THE DESIGN STRENGTH OF FUEL CANS FOR LIQUID-METAL-COOLED FAST REACTORS
G. Schmidt [1969] 145 p refs Transl. into English from German Rept. KFK-808 Sponsored by US-Euratom Fast Reactor Exchange Program
(EURFNR-570; EUR-3968.D; KFK-808) Avail: CFSTI

The method described can be used for calculating the size of the necessary fission gas plenum as a function of wall thickness and burn-up for the fuel rod cans of liquid metal-cooled oxide-fueled fast reactors for given material properties (especially creep behavior) and temperature and power distribution at the individual rod. A mathematical technique is applied to various examples by means of digital computer programs, and the results enable conclusions to be drawn concerning optimum fuel element design. Author (NSA)

N69-29109# Commissariat a l'Energie Atomique, Cadarache (France). Centre d'Etudes Nucleaires.
DETERMINATION OF THE TEMPORAL EVOLUTION OF A DOMAIN DEFINED BY A SYSTEM OF PARTIAL DIFFERENTIAL EQUATIONS. APPLICATION TO A NUCLEAR FUEL [DETERMINATION DE L'EVOLUTION TEMPORELLE D UN DOMAINE DEFINI PAR UN SYSTEME D'EQUATIONS AUX DERIVEES PARTIELLES. APPLICATION A UN COMBUSTIBLE NUCLEAIRE]
H. Chareton, J. L. Corriol, and P. Poulard [1969] 20 p In FRENCH Presented at the Intern. Symp. on Analogue and Hybrid Computation Applied to Nucl. Energy, Versailles, France, 16 Sep. 1968
(CEA-CONF-1126; CONF-680941-2) Avail: AEC Depository Libraries

The analog techniques used to determine optimum peak power for a fast oxide reactor core, without fuel melting, are detailed. The heat, densification, and conservation of mass equations are formulated; constraints and boundary conditions are defined. Utilization of the discrete ordinates technique for solution to the system of partial differential equations is discussed. Procedures for setting up and solving the analog system are given; results are shown graphically. NSA

N69-29114# Los Alamos Scientific Lab., N.Mex.
ULTRA HIGH TEMPERATURE REACTOR EXPERIMENT (UHTREX) Quarterly Status Report for Period Ending 31 Oct. 1968
7 Feb. 1969 13 p refs
(Contract W-7405-eng-36)
(LA-4094-MS) Avail: CFSTI

Operations at UHTREX during August to October 1968 are described. Topics discussed include: operations, reactor physics; and engineering research and development. NSA

N69-29143*# National Aeronautics and Space Administration, Washington, D.C.

VOID REACTIVITY RESPONSE IN BOILING WATER REACTORS

Tsutomu Kanai, Toshio Kawai, and Rei Aoki Jun. 1969 33 p refs Transl. into ENGLISH from Nippon Genshiryoku Gakkaishi (Tokyo), v. 3, no. 3, 1961 p 168–178

(NASA-TT-F-12240) Avail: CFSTI CSCL 18K

The void equation is derived from the fundamental equations of mass and energy conservation and the assumption of slip ratio in order to analyze void reactivity response caused by disturbances of inlet water velocity, inlet water temperature, system pressure, and reactor power. The partial differential equation is expressed in terms of void volume fraction, time, channel length, void transmission velocity, and effective heat source. Negative void is introduced to treat reactivity response caused by water temperature change in the subcooled region in the same manner as in the boiling region. This void equation is applied to analyze kinetic behavior of a typical power reactor. The linearized void equation is also derived and the void reactivity response diagram is obtained instead of the ordinary one using the void map. Author

N69-29236*# National Aeronautics and Space Administration, Washington, D.C.

PRESENT SITUATION AND FUTURE PROSPECTS OF CONTROLLED NUCLEAR FUSION [DEN KONTROLLERADE KARNFUSIONENS NULAGE OCH FRAM TIDSUTSIKTER]

Bo Lehnert Jun. 1969 29 p Transl. into ENGLISH from Swedish Rept.

(NASA-TT-F-12237) Avail: CFSTI CSCL 18K

Power production based on controlled fusion of deuterium and tritium nuclei, in order to meet the demands for a strongly enhanced energy consumption, is presented. For the controlled release of fusion energy in a reactor, a fully ionized gas of heavy hydrogen has to be kept at a temperature of the order of millions of degrees Kelvin during times of the order of seconds. A self-sustained fusion reaction is, therefore, only possible if the ionized gas (the plasma) is prevented in a very efficient way from getting into contact with the walls of the reaction chamber. The most promising method in this respect is to use a magnetic field in the shape of a magnetic bottle which confines the plasma. In addition to this, methods are required for heating the plasma to the necessary temperature range, as well as a number of technical arrangements for the generation of the magnetic field and the development of the reaction chamber. Author

N69-29237# Commissariat a l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucleaires

EXPERIMENTAL STUDY OF THE RAPSODIE PROTECTIONS [ETUDE EXPERIMENTALE DES PROTECTIONS DE RHAPSODIE]

Marcel Chapelet, Jean-Claude Edeline, and Gilbert Lhiaubet Oct. 1968 192 p refs In FRENCH

(CEA-R-3626) Avail: AEC Depository Libraries

Details of the protection tests which have been carried out by the Protection Sub-Commission during the starting-up trials on the reactor RAPSODIE are described. The main types of tests reported concern the flux measurements in the core, the reflectors, the Na and the near biological protections, the radio-protection measurements in the premises, and the activation of the principal fluids. The results obtained are analyzed and compared to predicted calculations. Author (NSA)

N69-29332# Kernforschungszentrum, Karlsruhe (West Germany). Inst. fuer Reaktorentwicklung.

THREE FORTRAN PROGRAMS FOR DETERMINING THE HOT CHANNEL TEMPERATURES IN STEAM AND GAS-COOLED REACTOR CORES WITH ALLOWANCES FOR TRANSVERSE COOLANT MIXING

K. Doetschmann Aug. 1968 29 p refs Transl. into ENGLISH from German Rept. KFK-815

(KFK-815; EURFNR-594; EUR-3973.d) Avail: CFSTI

Three FORTRAN digital computer programs are presented which deal with the optimization of gas- and steam-cooled reactor fuel element design. COMIX 1 calculates the temperature in fuel rod bundles for transverse coolant mixing and isobar calculation. COMIX 2 calculates the temperatures in fuel rod bundles for transverse coolant mixing with a pressure drop. COMIX 3 calculates the temperatures of peripheral cooling channels in fuel rod bundles with transverse mixing. NSA

N69-29367 Northwestern Univ., Evanston, Ill.

OPTIMIZATION OF DISTRIBUTED-PARAMETER TUBULAR REACTORS

John David Paynter (Ph.D. Thesis) 1968 205 p

Avail: Univ. Microfilms: HC $9.25/Microfilm $3.00 Order No. 69-1908

The optimal design of a steady-state packed bed tubular reactor is considered where both radial and axial gradients of temperature and extent of reaction are important. The object of the optimization is to maximize the extent of reaction leaving a reactor of fixed length and catalyst volume by choosing the optimal wall heat flux and/or reactor radius as a function of length. Two reaction systems are considered, the oxidation of SO_2 and the oxidation of o-xylene. An approximate method is introduced which replaces the solution of adjoint partial differential equations with solution of adjoint ordinary differential equations at the necessary suboptimality conditions. This approximate method greatly reduces computational time and makes possible the use of lumped-parameter optimization methods. This is done however with a sacrifice in mathematical exactness (i.e., only suboptimal solutions are found for the cases considered). Dissert. Abstr.

N69-29379# Atomics International, Canoga Park, Calif.

SURVEY OF FISSION- AND CORROSION-PRODUCT ACTIVITY IN SODIUM- OR NaK-COOLED REACTORS

G. B. Zwetzig 28 Feb. 1969 13 p refs

(Contract AT(04-3)-701)

(AI-AEC-MEMO-12790) Avail: CFSTI

Data from seven instances of fission-product release to the coolant and cover gas of Na- or NaK-cooled reactors are listed. The reactors include: SRE; HNPF; Fermi; BR-5; Dounreay (DFR); EBR-2; and SBER. NSA

N69-29411# Idaho Nuclear Corp., Idaho Falls.

REACTOR PHYSICS RESULTS FROM LOW-POWER MEASUREMENTS IN THE ADVANCED TEST REACTOR

N. C. Kaufman, J. L. Dumey, J. C. Teppendorf, and J. B. Willis Feb. 1969 50 p refs

(Contract AT(10-1)-1230)

(IN-1260) Avail: CFSTI

Power distribution and outer shim calibration data show that the outer shim modifications following the initial ATR startup did not change the previously demonstrated ATR-ATRC nuclear correspondence. The outer shim calibration data also indicate that the small difference in excess reactivity, ≈0.3$, between ATR and ATRC is the same as observed previously. Increasing the reactor coolant temperature caused only slight changes (≈2% in safety rod and shim worths. Increasing the loop coolant temperature caused a 9% decrease in the No. 1 neck shim set worth, a 12% increase in outer shim S34 worth, and only slight changes in regulating rod and safety rod worths. Fast (>1 MeV) neutron flux and γ heating measurements produced data with the expected axial cosine distributions. Comparison of these data with ATRC data indicate that ATR fast neutron flux and γ heating (for positions near the fuel) can be predicted from low power ATRC measurements with 5 and 20 percent uncertainties, respectively. Author (NSA)

N69-29450 Illinois Univ., Urbana.
AN EXPERIMENTAL STUDY OF STEADY STATE MULTIPLICITY AND STABILITY IN A LOOP REACTOR
Ronald Bradley Root 1968 160 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-1427

Steady state multiplicity and stability in an adiabatic loop reactor were studied in experiments employing the reaction between sodium thiosulfate and hydrogen peroxide in aqueous solution. The similarity between a simple plug-flow model for the loop reactor with negligible axial dispersion and an adiabatic batch reactor was the basis for a technique developed to predict the steady state characteristics of the loop system. The technique employed batch data of temperature versus time directly. The predictions did not require any knowledge of chemical kinetics, but the assumption of a single-step reaction mechanism was necessary. Multiple steady states in the loop reactor were predicted for a wide range of feed flow rates and recycle ratios. Several of the predicted cases were studied experimentally. The experimental results verified the existence of multiple steady states in the loop reactor. Dissert. Abstr.

N69-29482# Gulf General Atomic, San Diego, Calif.
EXPERIMENTAL TEST OF THE FREVAP-8 CODE FOR CALCULATING METAL FISSION PRODUCT RELEASE FROM HTGR FUEL ELEMENTS
H. J. de Nordwall, V. H. Pierce, and L. R. Zumwalt 1 Nov. 1968 9 p refs
(Contract AT(04-3)-167)
(GA-9093) Avail: CFSTI

In the FREVAP-8 calculation it is assumed that the migration of fission product metals such as Ba and Sr through the fuel-free graphite that separates HTGR-type fuel from the He coolant can be represented by steady-state diffusion equations. Observed and calculated releases from experimental fuel elements irradiated in the PLUTO loop of the DIDO, and the GAIL loop of the GETR are compared. Results are presented. NSA

N69-29545# Union Carbide Nuclear Co., Oak Ridge, Tenn. Y-12 Plant.
CRITICALITY RESEARCH AT THE OAK RIDGE CRITICAL EXPERIMENTS FACILITY
J. T. Thomas 1968 31 p Presented at Meeting of the Am. Nucl. Soc., Washington, D.C. 10-15 Nov. 1968
(Contract W-7405-ENG-26)
(Y-DR-7; CONF-681101-13) Avail: CFSTI

Criticality studies are described for UF_6 shipping containers, HFIR core storage, 25 annular uranium billets, borosilicate glass and uranyl-nitrate solutions, unreflected and reflected uranyl-nitrate solutions, and spherical units with fissile material, density for constant cell volume. NSA

N69-29547# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
THERMAL RANGE LIBRARY FOR GAMBIT PROGRAM
L. L. Moran, G. Collier, A. S. Johnston, and G. Gibson Jul. 1968 114 p refs
(WANL-TME-1830) Avail: CFSTI

The cross section library used by the GAMBIT program in the thermal range is described. Also included are sections which describe the UPDATE program which creates and alters thermal library tapes, the MODCHEK program which is used to check moderators, a discussion of the formation of the moderator kernels, and a series of plots of the scattering cross sections of the moderators. Author (NSA)

N69-29593*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NEUTRONIC COMPARISON OF BERYLLIUM OXIDE AND MOLYBDENUM FOR MOVABLE REFLECTOR CONTROL OF A FAST-SPECTRUM REACTOR
Charles L. Whitmarsh, Jr. and Wendell Mayo Washington Jun. 1969 26 p refs
(NASA-TM-X-1822) Avail: CFSTI CSCL 18K

A neutronic comparison of beryllium oxide and molybdenum as the major constituents of axially translating radial reflectors for the reactivity control of a fast-spectrum reactor is made. Both one- and two-dimensional transport calculations are used. The analysis indicates that the multiplication factors, power distributions, and reactivity control worth are nearly the same for both types of reflector materials. The normally higher worth of the beryllium oxide reflector is reduced because of (1) the presence of molybdenum canning material in the reflector and a tantalum alloy pressure vessel between the core and the reflector, and (2) the need to provide cooling and helium containment. Author

N69-29637# Kernforschungszentrum, Karlsruhe (West Germany). Institut fuer Reaktorentwicklung.
THREE FORTRAN PROGRAMS FOR DETERMINING THE HOT CHANNEL TEMPERATURES IN STEAM AND GAS-COOLED REACTOR CORES WITH ALLOWANCES FOR TRANSVERSE COOLANT MIXING [DREI FORTRAN-PROGRAMME ZUR BESTIMMUNG DER HEISSKANAL-TEMPERATUREN IN DAMPF- UND GASGEKUEHLTEN REAKTORKERNEN UNTER BERUECKSICHTIGUNG DER KUEHLMITTEL-QUERVERMISCHUNG]
K. Doetschmann Aug. 1968 25 p refs In GERMAN Sponsored by US-Euratom Fast Reactor Exchange Program
(KFK-815; EURFNR-584; EUR-3973.d) Avail: CFSTI

Three FORTRAN digital computer programs are presented which deal with the optimization of gas- and steam-cooled reactor fuel element design. COMIX 1 calculates the temperature in fuel rod bundles for transverse coolant mixing and isobar calculation. COMIX 2 calculates the temperatures in fuel rod bundles for transverse coolant mixing with a pressure drop. COMIX 3 calculates the temperatures of peripheral cooling channels in fuel rod bundles with transverse mixing. NSA

N69-29671*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
USE OF "FASTER" CODE FOR SIGNIFICANTLY REDUCING DUCTED REACTOR SHIELD COMPUTATION TIME
Millard L. Wohl and Thomas M. Jordan (ART Res. Corp., Los Angeles) Washington Jul. 1969 8 p refs
(NASA-TM-X-1828) Avail: CFSTI CSCL 18I

The neutron number spectrum computed by the FASTER code at point detectors in a ducted water slab configuration is compared with similar results generated by the OSR code. Excellent agreement is found, verifying the quick-running FASTER code for this type of shielding analysis. Author

N69-29815# European Atomic Energy Community, Brussels (Belgium).
SHOCK STRUCTURE INTERACTIONS IN REACTOR VESSELS
Oct. 1968 404 p refs Papers presented at a EURATOM Meeting held at Ispra, Italy, 27–30 Jun. 1966; sponsored jointly by ENEA and EURATOM
(EUR-4101.F.E) Avail: CFSTI

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9. EXPERIMENTS TO EXAMINE THE EFFECT OF RAPID STRAIN RATES ON FULL SCALE AND MODEL SCALE REACTOR MATERIALS N. J. M. Rees (Atomic Weapons Res. Estab., Foulness, England) p 211–216 refs (See N69-29824 16-22)

10. EFFECT OF STRAIN RATE ON FRACTURE STRENGTH OF CONVENTIONAL STRUCTURAL STEELS W. S. Pellini (Naval Res. Lab.) p 217–220 refs (See N69-29825 16-32)

11. EXPERIMENTS AND ANALYSIS ON THE PERFORMANCE OF CRUSHABLE BLAST SHIELDS T. A. Zaker and P. Lieberman (IIT Res. Inst., Chicago, Ill.) p 221–249 refs (See N69-29826 16-22)

12. THE RESPONSE OF A VESSEL TO AN INTERNAL BLAST LOADING H. Holtbecker, A. Maserati, M. Montagnani, and G. Verzeletti (European Atomic Energy Community, Ispra, Italy) p 251–304 refs (See N69-29827 16-32)

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14. MECHANICAL EFFECTS OF THE RUPTURE OF A PRESSURE TUBE WITH PRESSURIZED GAS IN A REACTOR OF THE TYPE EL4 R. Roche (Comm. a l'Energie Atomique, Saclay, France) p 325–344 refs (See N69-29829 16-22)

15. FULL SCALE EXPERIMENT ON THE CONSEQUENCES OF A PRESSURE TUBE RUPTURE IN ESSOR REACTOR VESSEL H. Holtbecker, M. Montagnani, and G. Verzeletti (European Atomic Energy Community, Ispra, Italy) p 345–377 refs (See N69-29830 16-22)

16. THE CALCULATION OF THE RESPONSE OF MODEL AND FULL SCALE REACTOR STRUCTURES TO DYNAMIC LOADINGS (United Kingdom Atomic Energy Authority, Foulness, England) p 379–391 refs (See N69-29831 16-22)

17. SIMULATION OF ACCIDENTAL EXPLOSIONS IN FAST REACTOR PILES M. Falgayrettes and J. P. Millot (Comm. a l'Energie Atomique, Cadarache, France) p 393–411 refs (See N69-29832 16-22)

N69-29816# United Kingdom Atomic Energy Authority, Risley (England).

DEPRESSURISATION AND WAVE PROPAGATION IN WATER COOLED REACTORS

A. R. Edwards *In* EURATOM Shock Struct. Interactions in Reactor Vessels Oct. 1968 p 1–22 refs (See N69-29816 16-22)

Avail: CFSTI

A brief discussion of areas in which pressure wave effects could be major factors in reactor safety is presented. The uncertainties that exist on wave propagation velocities are mentioned, and the nature of a series of U.K. tests involving heating of the reactor vessel and pipework is described. Topics of primary interest for theoretical and experimental investigation included: (1) propagation of pressure waves in two-phase mixtures; (2) sequence of events following a depressurization accident in a high temperature water reactor; and (3) model scaling considerations for two-phase flow conditions. The results of theoretical studies indicated that a better understanding of the factors affecting nucleation is needed to explain critical flow phenomena in many instances. A.C.R.

N69-29817# European Atomic Energy Community, Ispra (Italy).

SOME THEORETICAL CONSIDERATIONS AND EXPERIMENTAL DATA ON PROPAGATION AND REFLECTION OF UNDERWATER PRESSURE AND SHOCK WAVES

H. Holtbecker and A. Maserati *In its* Shock Struct. Interactions in Reactor Vessels Oct. 1968 p 23–74 refs (See N69-29815 16-22)

Avail: CFSTI

A detailed study of pressure wave decay during propagation, where the wave is generated by one of a number of possible causes, is described. Pressure values which are reached if the wave is reflected from a structure are also calculated. Three aspects of wave propagation were emphasized: (1) propagation from source to structure; (2) wave behavior from moment of impact on the structure; and (3) events occurring when a pressure wave impinges on a reactor channel, including shadow phenomena due to the tube, wave diffraction and its possible enhancement in travelling through the pressure tube reactor lattice, and reflection from a pressure tube. A.C.R.

N69-29818# United Kingdom Atomic Energy Authority, Risley (England).

SHOCK WAVES AND TRANSIENT LOADING FROM CHEMICAL REACTIONS

J. G. Moore *In* EURATOM Shock Struct. Interactions in Reactor Vessels Oct. 1968 p 75–88 refs (See N69-29815 16-22)

Avail: CFSTI

Several types of chemical reactions within a nuclear reactor which could lead to the generation of shock waves, with resulting transient loading conditions, are briefly considered. These include a sodium–air reaction in sodium cooled reactors, where a fine spray of sodium partly fills an air filled enclosure; the explosive hazard following release of hydrogen into a reactor containment system; and a sodium-water reaction in a sodium heated steam generator, caused by tube leakage from the heat exchanger. A.C.R.

N69-29819# IIT Research Inst., Chicago, Ill.

WATER DEPRESSURISATION STUDIES

T. A. Zaker and A. H. Wiedermann *In* EURATOM Shock Struct. Interactions in Reactor Vessels Oct. 1968 p 89–124 refs (See N69-29815 16-22)

(Contract AT(11-1)-578)

Avail: CFSTI

Decompression and blowdown phenomena, which are often accompanied by transient wave propagation through a reactor system, are discussed, based on laboratory experiments using a water-driven shock tube. A brief description of the depressurization equipment and some observations on blowdown conditions are included. In addition, theoretical depressurization calculations are made, followed by comparison of the results with experiment. It is

concluded that depressurization of heated, pressurized water and water-steam mixtures leads to blowdown phenomena that are qualitatively different in some respects then those due to gas rupture in a pressure tube. This is apparently due to the variation of sound speed with mixture quality in a two-phase flow of water and steam. A.C.R.

N69-29820# Internationale Atomreaktorbau Gesellshaft, Bensberg (West Germany).
EXPERIMENTAL AND THEORETICAL INVESTIGATIONS OF SODIUM-WATER REACTIONS IN TUBES
K. Dumm, H. Mausbeck, and W. Schnitker *In* EURATOM Shock Struct. Interactions in Reactor Vessels Oct. 1968 p 125–142 refs (See N69-29815 16-22)
Avail: CFSTI

A series of basic experiments to obtain better understanding of sodium–water reactions in tubes and to develop an adequate mathematical program for their description was conducted. This information was necessary in developing a compact, sodium-cooled, zirconium hydride-moderated test reactor of 20 megawatt electric output, with two steam generators of the concentric tube-in-tube design. In this design, sodium and water are isolated only by a single tube wall, and uncertainties exist as to the possibility of tube failures resulting from long term corrosion, as well as of the durability of protective magnetite layers on the water-stream side. The test facility, reaction measuring equipment, and experimental results of tests on the shut-off devices installed at the steam generators are described. A refined mathematical model for predicting the first pressure peak and the time of pressure development is also included. A.C.R.

N69-29821# Atomic Weapons Research Establishment, Foulness (England)
MODEL TECHNIQUES IN REACTOR ACCIDENT SIMULATION
N. S. Thumpston *In* EURATOM Shock Struct. Interactions in Reactor Vessels Oct. 1968 p 143–151 refs (See N69-29815 16-22)
Avail: CFSTI

A technique for assessing reactor damage under accident conditions, with emphasis on investigating the problems of structural failure from dynamic loads, is described. The essential feature of the model is that it is either smaller than the prototype structure or is a small section of the full scale structure. The techniques of energy release simulation, as well as the structural model, scaling laws, and instrumentation, are treated. Examples of experiments using models in which the energy source is pressurized gas and those with energy insertion by electrical pulse heating or explosive charge methods are then given. A.C.R.

N69-29824# Atomic Weapons Research Establishment, Foulness (England).
EXPERIMENTS TO EXAMINE THE EFFECT OF RAPID STRAIN RATES ON FULL SCALE AND MODEL SCALE REACTOR MATERIALS
N.J.M. Rees *In* EURATOM Shock Struct. Interactions in Reactor Vessels Oct. 1968 p 211–216 refs (See N69-29815 16-22)
Avail: CFSTI

The dynamic properties of high temperature stainless steel, used in parts of a structural reactor model that would be deformed by the occurrence of an explosion, are compared at the full scale strain rate with those of mild steel used in model strain rate measurements. The ratio of the model rate of strain to the full scale rate was equal to the scale factor. Tests were conducted using small specimens with high strain rates to determine the tensile properties of the two steels. No final results were reported, since the tests were still in the preliminary stages. A.C.R.

N69-29826# IIT Research Inst., Chicago, Ill.
EXPERIMENTS AND ANALYSIS ON THE PERFORMANCE OF CRUSHABLE BLAST SHIELDS
I. A. Zaker and P. Lieberman *In* EURATOM Shock Struct. Interactions in Reactor Vessels Oct. 1968 p 221–249 refs (See N69-29815 16-22)
(Contract AT(11-1)-578)
Avail: CFSTI

Systematic experimental and analytical methods were developed for evaluating the performance of blast attenuators or layered crushable material. The data prove useful in optimizing the design of reactor shields for containing the effects of maximum, credible, explosive energy release. Specifically, experiments to determine equations of state of a porous solid under shock loading were conducted, and analysis was made of wave propagation in crushable solids. A.C.R.

N69-29829# Commissariat a l'Energie Atomique, Saclay (France).
MECHANICAL EFFECTS OF THE RUPTURE OF A PRESSURE TUBE WITH PRESSURIZED GAS IN A REACTOR OF THE TYPE EL4 [EFFETS MECANIQUES DE LA RUPTURE D'UN TUBE DE FORCE A GAZ SOUS PRESSION DANS UN REACTEUR DU TYPE EL4]
R. Roche *In* EURATOM Shock Struct. Interactions in Reactor Vessels Oct. 1968 p 325–344 refs In FRENCH (See N69-29815 16-22)
Avail: CFSTI

With reference to the tubes which contain the combustible elements, which cross the heavy water tank and mechanically resist the effects of the pressurized gas stream which cools the combustible elements, the effects of a possible rupture are investigated. The mechanical consequences of such a rupture are studied in two categories: (1) the local consequences relating to the effects on the neighboring tubes, and (2) the overall consequences concerning the evolution of pressure in the heavy water tank following the eruption of the gas liberated by the rupture. The studies showed that, for the quality of the tube utilized in EL4 and for the internal anticipated equipment, there was no risk that the rupture of the pressure tube would bring about similar ruptures of the neighboring tubes. The value of the maximal pressure in the tank was determined, so that it could be dimensioned in such a way as to survive the accident. Transl. by P.A.B.

N69-29830# European Atomic Energy Community, Ispra (Italy).
FULL SCALE EXPERIMENT ON THE CONSEQUENCES OF A PRESSURE TUBE RUPTURE IN ESSOR REACTOR VESSEL
H. Holtbecker, M. Montagnani, and G. Verzeletti *In its* Shock Struct. Interactions in Reactor Vessels Oct. 1968 p 345–377 refs (See N69-29815 16-22)
Avail: CFSTI

One phase of a core safety study, whose object was to insure that the individual units remain independent in the event of an accident, is discussed. The factors which are associated with this problem are also enumerated, and formulas are derived for the effects of the pressure wave produced by a burst channel. Pressure transients due to moderator vaporization and fast condensation, static loading of the vessel, and temperature rise in the channels affected by the organic jet are discussed. A.C.R.

N69-29831# United Kingdom Atomic Energy Authority, Foulness (England).
THE CALCULATION OF THE RESPONSE OF MODEL AND FULL SCALE REACTOR STRUCTURES TO DYNAMIC LOADINGS
N. J. M. Rees *In* EURATOM Shock Struct. Interactions in Reactor Vessels Oct. 1968 p 379–391 refs (See N69-29815 16-22)
Avail: CFSTI

The effect of an explosion is examined in the core of the prototype fast reactor using models having linear dimensions 1/10th of the full scale reactor. Figures representing a cross section and plan of the model are presented, along with an explanation of the instrumentation used to measure the forces acting on the core plug and roof of the model reactor structure. The deflexion of an edge fixed roof panel under dynamic pressure loading is investigated mathematically; the responses of the model structural roof, as well as of a full scale structural roof, to an impact pressure loading are calculated. The work is being carried out on a small PACE analog computer. P.A.B.

N69-29832# Commissariat a l'Energie Atomique, Caderache (France).
SIMULATION OF ACCIDENTAL EXPLOSIONS IN FAST REACTOR PILES [SIMULATION D'ACCIDENTS EXPLOSIFS SUR LES PILES RAPIDES]
M. Falgayrettes and J. P. Millot *In* EURATOM Shock Struct. Interactions in Reactor Vessels, Oct. 1968 p 393–411 refs In FRENCH
Avail: CFSTI

The explosion simulation technique used, in a study to determine the behavior of the Rapsodie reactor, consists of placing an explosive at the center of the core in a reduced scale model. The evolution of energy discharge in the model, as a function of time, is close to that assumed for a fast reactor at the time of an accident. Using this model, the behavior of the reactor vessel, of the watertight vessel, and of the upper core plugs of the reactor were examined, as to pressure wave propagation, the constraints produced, and component deformations. In order to assess the influence of the scale, two series of experiments were carried out, using models with scales of 3/10 and 1/10. The effects of replacing the sodium with water were studied. Transl. by P.A.B.

N69-29915# Phillips Petroleum Co., Idaho Falls, Idaho. Atomic Energy Div.
LOFT PROGRAM OFFICE Quarterly Technical Report, 1 Jul.–30 Sep. 1968
K. A. Dietz, ed Feb. 1969 55 p refs
(Contract AT(10-1)-205)
(IDO-17266) Avail: CFSTI

Design parameters of reactor fuel elements and continuous radiation monitoring are described. One-dimensional approximation for inlet pipe failure in pressurized water reactors is presented. Reactor safety experiments are reported; they include temperature profiles for FHUST and MOXY, pressure profiles, and unperturbed analysis of iodine-131 for LOFT–ECC. J.A.M.

N69-29988# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
ORGEL DYNAMICS
W. Balz, C. Bons, A. Decressin, H. D'Hoof, F. Lafontaine et al 1969 275 p
(Proj. ORGEL)
(EUR-4254.e) Avail: CFSTI

Different studies were undertaken, in the frame of the ORGEL project, in order to investigate and to analyze the stability and the dynamic behavior of an ORGEL type reactor coupled to a 250 MWeg power plant. In the first part of the studies the heat exchanger attached to the reactor is a drum boiler. The model of simulating the power plant is explained. The studies have been taken up again at the request of the industrial group participating in the "ORGEL Prototype Contest". According to their choice the heat exchanger investigated is of the Benson type. Author

N69-30010# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
REFLOS: A CODE FOR THE REFINED EVALUATION OF FUEL LOADING SCHEMES
W. Bottcher, E. Schmidt, W. De Haan, F. Handt, J. Ligeon, et al 1969 131 p refs
(EUR-U250.e) Avail: CFSTI

The REFLOS represents a code for the refined evaluation of fuel loading schemes in heavy water moderated reactors or, more generally, in reactors with weakly absorbing moderator. Its scope is to determine reactivity behavior, power-distribution, attainable burn-up and fuel cycle cost for both the running-in period and the equilibrium of a power reactor. The REFLOS has been written in FORTRAN 4 for the IBM 360/65 computer. The report gives a survey about the methods applied in the individual subroutines of REFLOS, a detailed description of the input parameters, and an example for input and output. Author

N69-30048# Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires.
STRUCTURE AND PROPERTIES OF (U, Pu)O_2 CONTAINING NON-ACTIVE FISSION PRODUCTS: A SIMULATION OF IRRADIATED NUCLEAR FUEL [STRUCTURE ET PROPRIETES DE (U, Pu)O_2 CONTENANT DES PRODUITS DE FISSION SOUS FORME INACTIVE]
Franz Schmitz Apr. 1969 43 p refs In FRENCH; ENGLISH summary
(CEA-R-3795) Avail: CFSTI

Oxides have been made with the same uranium and plutonium content, the same stoichiometry and the same fission after two per cent burn up. The stoichiometry changes due to irradiation have been calculated by X-ray parameter measurements. The contractions of the oxide lattice due to fission products in solid solution have also been calculated and measured. Microprobe analyses of precipitates have been made and lead to the identification of non-metallic barium containing compounds and showed the special role of molybdenum. Some physical properties of these materials, e.g., electrical resistivity, thermal diffusivity, and the vapor pressure of zirconium in solid solution were also measured. Author (ESRO)

N69-30068# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Nuclear Labs.
THERMAL CONDUCTIVITY OF ThO_2-PuO_2 UNDER IRRADIATION
A. T. Jeffs Apr. 1969 40 p refs
(AECL-3294) Avail: Atomic Energy of Can., Ltd., Chalk River: $1.00

The ThO_2–PuO_2 fuels are of interest as the possible first charge of reactor systems utilizing the ^{232}Th–^{233}U cycle. An important parameter of any fuel is its thermal conductivity under service conditions and this has been measured at low exposures for sintered fuel of 98.5% T.D. using an instrumented fuel rod. The results show that up to the maximum temperature recorded in this test, 1630°C, the integrated thermal conductivity of thoria-based fuels is improving steadily with increasing temperature, relative to that of UO_2. At the highest temperature of measurement the difference is about 25%. Author

N69-30070*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
AN ANALOG COMPUTER STUDY OF THE LOW-FREQUENCY FLOW DYNAMICS OF TWO NUCLEAR ROCKET COLD-FLOW ENGINE SYSTEMS
Harry W. Fox, Jr. and Ronald J. Blaha Washington Jul. 1969 85 p refs
(NASA-TN-D-5312) Avail: CFSTI CSCL 21F

An analog computer study is made of the low-frequency flow dynamics observed with liquid hydrogen flowing in two different nuclear-rocket cold-flow (unfueled) engine systems. The prediction of the low-frequency response depends largely upon the generation of the proper mass-flow storage in the system. This is achieved by relating, in the model lumping, the average values of

fluid enthalpy and a certain thermodynamic fluid property. A two-phase state equation is derived for thermodynamic equilibrium between the gas and liquid phases. Parametric studies are made which demonstrate the effect of the pump characteristics on the flow damping. Author

N69-30081# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
REACTIVITY MEASUREMENTS ON SUBCRITICAL NUCLEAR REACTOR USING STATISTICAL FLUCTUATIONS OF THE NEUTRON FLUX [MESURE DE LA REACTIVITE D'UN REACTEUR NUCLEAIRE EN REGIME SOUS-CRITIQUE A PARTIR DES FLUCTUATIONS STATISTIQUES DE FLUX NEUTRONIQUE]
Emad-ed-Din Feghahati (Ph.D. Thesis--Paris Univ., 5 Jul. 1968) Mar. 1969 87 p refs In FRENCH; ENGLISH summary
(CEA-R-3696) Avail: CFSTI

This report shows that it is possible to construct an apparatus for measuring the reactivity of a sub-critical nuclear reactor by making a spectral analysis of the variations in the output signal of a counter. The proposed method consists of the measurement of the spectral density in two frequency bands, and the determination of the 'uncorrelated' components so as to obtain the 'correlated' components giving the reactivity if $\beta/1$ is known. It is concluded that this method could be applied with the help of a simple apparatus having a measurement range of up to -- 5000 pcm. Since the efficiency of the detector cannot be increased above a certain value, the accuracy depends largely on the time of measurement and it is shown that it is possible to measure -- 3000 pcm with an accuracy of ± 5 per cent with 600 seconds measurement time. Author (ESRO)

N69-30090# Commissariat à l'Energie Atomique, Chuscian (France). Centre de Production de Plutonium.
REVIEW OF THE INCINERATION OF 500 TONS OF RADIOACTIVE RESIDUES [BILAN DE L'INCINERATION DE 500 TONNES DE RESIDUS RADIOACTIFS]
Jean Rodier, Philippe Seyfried, and Michel Charbonneaux Apr. 1968 17 p refs In FRENCH; ENGLISH summary
(CEA-R-3721) Avail: CFSTI

During its first five years operation, the incinerator at the Marcoule Center has burnt almost 500 tons of radioactive residues. Improvements in some of the details of the process have been made during this period particularly concerning the nature of the materials involved. The technical and radiological results for the installation are very favorable, and have made it possible to maintain a high charge factor. Although the overall economic results are not advantageous in the case of ungraded solid residues this method represents nevertheless the best available for eliminating oils, solvents, wood and dead animals. It can also be of use when a dilution in the atmosphere can be advantageously used as a method of disposing of certain radioelements such as tritium or carbon 14 in the form of gases or vapors. Author (ESRO)

N69-30180# Atomic Energy Commission Research Establishment, Riso (Denmark). Reactor Physics Dept.
FORMULATIONS AND SOLUTIONS OF XENON OVERRIDE PROBLEMS FOR THERMAL REACTORS WITH SPECIAL REFERENCE TO PRACTICABLE RELEVANCE AND PHYSICAL FEASIBILITY
Georg Gottschalk Oct. 1968 83 p refs
(RISO-M-786) Avail: CFSTI

The classical formulations of xenon override problems for thermal neutron reactors are made for research reactors only, and they contain only crude constraints on the variables, which causes steep power gradients and temperature gradients. Therefore the problems have been reformulated with reference to power reactors as well, and with reference to physical feasibility. This report contains a description of the classical and the new formulations and solutions of xenon override problems. It contains a description of the computer code XEDYPNY (AEK Programme No. 499) evaluated to solve these problems. Author (ESRO)

N69-30243# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
PYROCHEMICAL SEPARATION OF PLUTONIUM IN IRRADIATED FUEL ELEMENTS [SEPARATION PYROCHIMIQUE DU PLUTONIUM DANS LES COMBUSTIBLES IRRADIES]
A. Avogadro and J. G. Wurm Apr. 1969 16 p refs In FRENCH; ENGLISH summary
(EUR-4242.f) Avail: CFSTI

An hybrid fuel cycle is investigated. This concept involves the Pu separation in an integrated pyrochemical plant followed by its final purification in a central plant by existing aqueous technology or by fluoride processes. The pyrochemical flow sheet being considered involves the oxidation of ceramic fuel in a nitrate melt followed by selective dissolution of the U in a fused chloride bath. This fuel cycle concept which combines the advantages of dry and aqueous reprocessing is economically attractive. Author

N69-30272# Naval Research Lab., Washington, D. C.
IRRADIATION EFFECTS ON REACTOR STRUCTURAL MATERIALS. Quarterly Progress Report, 1 Nov. 1968-31 Jan. 1969
L. E. Steele, J. R. Hawthorne, O. Z. Serpan, Jr., Uldis Potapovs, H. E. Watson et al 15 Feb. 1969 29 p refs
(AD-685591; NRL-MR-1962) Avail: CFSTI CSCL 18/10

The report includes the following: (1) development of dynamic tear test facility, (2) properties of steels irradiated in the Big Rock Point Reactor, (3) fracture evaluation of irradiated A302-B and A543 steel plate and weld metals, (4) response of A350-LF1 (Mod.) steel to cyclic irradiation and annealing treatments, and (5) fractographic examination of variable irradiation sensitivity steels. Author (TAB)

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N69-29113# Los Alamos Scientific Lab., N.Mex.
EFFECT OF AN OSCILLATING QUADRUPOLE FIELD ON THE KINK MODES OF A SCREW PINCH
F. I. Ribe 17 Feb. 1969 7 p refs
(Contract W-7405-eng-36)
(LA-4081-MS) Avail: CFSTI

Dynamic stabilization of the kink modes in a linear z pinch by means of oscillating quadrupole fields has been reported by Odinskii. The case of the screw pinch (with longitudinal magnetic field, as in a θ pinch) where the modes are helical is investigated. The quadrupole field (with no twist or rotational transform) couples the left- and right-handed modes, giving two new normal modes, one of which is unstable. The unstable normal mode is not stabilized by the oscillating quadrupole. Author (NSA)

N69-29124# Massachusetts Univ., Amherst. School of Engineering.
PRELIMINARY DESIGN OF AN ACOUSTIC WATER TUNNEL
H. Mongia and G. A. Russell [1969] 22 p refs
(Contract N00014-68-A-0146; Proj. THEMIS)
(AD-682232; THEMIS-UM-69-1) Avail: CFSTI CSCL 20/1

The report describes various water tunnel configurations suitable for acoustical studies together with appropriate design calculations and an estimate of power requirements for the various tunnel designs. The general tunnel requirements which were used are (1) Mach numbers in the range of 1.000.000, (2) A test section large enough to handle small models, and (3) Acoustically treated walls and quiet pumping. Preliminary cost estimates of several tunnel configurations are also included. Author (TAB)

N69-29234 Stanford Univ., Calif.
THE INTERACTION OF LIGHT AND SOUND
Christopher David Wicks Wilkinson (Ph. D. Thesis) 1968 195 p
Avail: Univ. Microfilms: HC $8.80/Microfilm $3.00 Order No. 69-314

The interaction of sound at microwave frequencies and light is discussed. Using the phenomenon of Bragg diffraction, many aspects of the propagation of sound were studied. A theoretical account of the diffraction of light from high frequency sound is given. Experimental evidence for two crucial features of this interaction is given: the frequency shift of the incident light frequency by an amount equal to the acoustic frequency, and the linear relationship between the intensity of the sound and the intensity of the diffracted light. Using a light beam smaller than the acoustic beam, Bragg diffraction may be used to probe the position, velocity, and intensity of the light. The attenuation of sound in Z-cut quartz and MgO were measured with increased accuracy using Bragg diffraction; the square low frequency dependence of the attenuation is measured. Bragg diffraction provides a means to measure ratios of certain photoelastic constants; data are presented for Al_2O_3 and MgO. Dissert. Abstr.

N69-29391 Maryland Univ., College Park.
NEAR INFRARED SPECTRA OF WATER AND AQUEOUS SOLUTIONS
Brian John Fitzpatrick (Ph.D. Thesis) 1968 109 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-717

The 1.2μ band of water was measured as a function of temperature and solute concentration. On inspection, this band appeared to be composed of three components. The variation of these components with temperature and added solute suggested that they might be related to three species in water, i.e., molecules with zero, one or two hydrogen bonds. In order to obtain a quantitative evaluation of the relative amounts of these three species, the band was resolved into its three components by fitting the observed band by the sum of three Gaussian curves, after suitable baseline corrections had been made. This was done for ice, water from 0° to 121°C at 10° intervals, and 8m $NaClO_4$ at 141°C. Since the doubly bonded species is the only one present in ice, only one Gaussian curve is needed. Since this species is isolated, the area of the curve can be taken as a relative extinction coefficient. From the variation with temperature of the other two components, the relative extinction coefficients of the other two species can be determined. Dissert. Abstr.

N69-29429*# California Univ., La Jolla. Department of Applied Physics and Information Science.
ESTIMATION OF OBJECT PARAMETERS BY A QUANTUM-LIMITED OPTICAL SYSTEM
Carl W. Helstrom [1968] 37 p refs
(Grant NGR-05-009-079)
(NASA-CR-101576) Avail: CFSTI CSCL 20F

By means of the quantum-mechanical form of the Cramer-Rao inequality, a lower bound is set to the mean-square error in an unbiased estimate of a parameter of an incoherently radiating object observed in the presence of thermal background light by an optical system admitting light through a finite aperture. Estimates of absolute radiance, frequency, and position of the object are specifically analyzed. The bounds reduce in the classical limit to those previously obtained, but are valid in the quantum limit as well. When the background vanishes, the bounds depend only weakly on the effective number of independent spatial and temporal degrees of freedom of the object light at the aperture. Author

N69-29477*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EXPERIMENTAL DETERMINATION OF EDDY-CURRENT TORQUES ON BODIES ROTATING RELATIVE TO A UNIFORM MAGNETIC FIELD
J. C. Boyle, E. J. Mosher, and J. M. Greyerbiehl Washington Jul. 1969 31 p refs
(NASA-TN-D-5086) Avail: CFSTI CSCL 20C

This report presents eddy-current torque measurements made on conducting bodies of various shapes. The results obtained are compared with available theory as well as with the findings of other experimenters. A novel feature of this program is that the test specimens were held stationary while the magnetic field was rotated. This not only eliminated problems of windage and bearing friction, but permitted extension of the tests into higher frequency ranges than had previously been investigated. Also included is a brief discussion of the implications to present and future spacecraft. Author

N69-29627 California Univ., Berkeley. Dept. of Physics.
CURRENTS IN S-MATRIX THEORY
Stanley Mandelstam *In* CERN Topical Conf. on Weak Interactions 27 Mar. 1969 p 349–360 refs (See N69-29504 18-24)
Copyright. Avail: Issuing Activity

The general types of equations used in calculations extending the method of dispersion relations to weak amplitudes are outlined. The question of conserved currents in general is discussed, along with conserved axial currants and their associated Goldstone bosons. The problem of the commutation relations between currents is considered from the viewpoint of S-matrix theory. Conserved axial currents and axial current commutation relations are then treated in detail, including an attempt to find concepts in hadron physics from which axial current conservation may be deduced. By making use of the Adler self-consistency condition alone, a number of properties of both strong and weak amplitudes are derived that are associated with PCAC and current commutation relations. Ideas suggested in order to link the Adler self-consistency condition with other properties of the hadron S-matrix are considered. It is shown that the commutation relation between total charges, unlike the local commutation relations between current densities, are consequences of the Adler self-consistency condition. Total charge commutation relations alone are sufficient to derive results such as the Adler–Weisberger equation. Author

N69-29584# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
FURTHER RESTRICTIONS ON THE HIGH-ENERGY BEHAVIOUR OF SCATTERING AMPLITUDE
Yu. M. Lomsadze, E. E. Kontrosh, and S. S. Toker 1968 23 p refs Presented at 2nd Conf. on Axiomatical Field Theory and Theory of Elementary Particles, Kiev, Apr. 1968
(ITF-68-38; CONF-680453-16) Avail: AEC Depository Libraries

The Modified Meyman theorem 1 is proved. Using it the Froissart-Martin upper bound is lowered for the scattering amplitude $f(s) = f(s,t = 0)$ under various assumptions about the behavior

of H(s) = Imf(s)/Ref(s) for physical s → ∞ in the absence of the pathologically strong oscillations of f(s) in the strictly formulated meaning. The Meyman theorem 1 is quoted and by making use of it new restrictions are obtained on the high-energy behavior of f(s). The restrictions are strengthened if the amplitude f(s) is free from the very strong oscillations–but again in the strictly formulated meaning. In all the proofs, one makes use of the amplitude analyticity only in the upper s-halfplane and takes into account that f(s) for real s is a distribution rather than a usual function. All the results are extended to the case of arbitrary binary reactions. The advantages of introducing the Meyman asymptotic amplitudes are pointed out. Author (NSA)

N69-29621*# Houston Univ., Tex. Dept. of Physics.
SPACE RELATED TECHNICAL INVESTIGATIONS Progress Report, 1 Oct. 1968-1 Mar. 1969
Alvin F. Hildebrandt 1 Mar 1969 30 p refs
(Grant NGR-44-005-022)
(NASA-CR-101578) Avail: CFSTI CSCL 20L

Summaries of work in progress are presented concerning atomic processes and solid state physics, the interaction of quantum fluids with physical boundaries, electron gases, electrohydrodynamics, and translations of works regarding differential forms as applied to physics. Contract proposals are included for a thermal method of measuring the quantity of a cryogenic fluid in a tank under zero-gravity conditions and a helium 2 momentum flux radiometer. M.H.E.

N69-29641# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
SCATTERING BY "NONPHYSICAL" POTENTIALS: ANALYTICITY IN COUPLING CONSTANT
Yu. M. Lomsadze 1968 23 p refs Presented at 2nd Conf. on Axiomatical Field Theory and Theory of Elementary Particles, Kiev, Apr. 1968
(ITF-68-46; CONF-680453-17) Avail: AEC Depository Libraries

A general method is given for investigating the nonrelativistic scattering by arbitrary "nonphysical" potentials $\lambda V(r) > O(r^{-2})$ when $r \to 0$, reducing the problem of calculating the partial-wave scattering amplitude to solving the inhomogeneous Volterra equation which may be iterated an arbitrary number of times. In contrast to the scattering by the "physical" potentials $\lambda V(r) \leq O(r^{-2})$ when $r \to 0$, the amplitude of scattering by the "nonphysical" potentials posses inevitably an unmovable singularity at the point $\lambda = 0$ as well as an essential singularity at the infinity in the s plane. The possible situation with the structure of the g^2 plane of field-theory scattering amplitude (g is the physical coupling constant) is discussed in three cases: quantal electrodynamics, unrenormalizable theories and renormalizable theories of strong interactions. Author (NSA)

N69-29753# National Research Council of Canada, Ottawa (Ontario).
SOUND ABSORPTION TESTS ON POLYURETHANE AND LIQUID SOAP FOAMS FOR ANECHOIC ENCLOSURES
G. Krishnappa, G. G. Lovy, and G. A. Macaulay Feb. 1969 18 p refs
(NRC-10667; MET-499) Avail: Issuing Activity

An investigation was made of the normal and random incidence absorption of samples of 2-in. thick polyurethane foam selected for use in the construction of an anechoic enclosure for lifting-fan noise studies. Impedance tube measurements gave normal incidence absorption coefficients ranging from 0.38 at 500 c/s to 0.91 at 1500 c/s. Reverberation time measurements carried out indicated a random incidence absorption coefficient of 0.79 at 500 c/s, increasing to almost 1.0 at 1250 c/s, after correction for diffraction effects. Reverberation time measurements on 1-in., 2-in., and 4-in. thick liquid soap foam showed high sound absorption. A 4-in. thick foam gave a random incidence coefficient of 0.72 at 300 c/s to 1.0 at 800 c/s. Author

N69-29780# Rome Air Development Center, Griffiss AFB, N.Y.
ELECTRON BEAM DISCHARGE DISTRIBUTION IN THE D-KDP CRYSTAL
Maris A. Sturans Mar. 1969 64 p refs
(AD-685228; RADC-TR-69-5) Avail: CFSTI CSCL 20/6

The utilization of the linear electro-optic effect for light modulation employs certain types of uniaxial crystals in which the indices of refraction are changed with the application of an electric field, making the crystals biaxial. This phenomenon can be made to result in a rotation of a linearly polarized light vector proportional to the applied field. If an electron beam is used to create the field within the crystal, the rotation of the light vector can be achieved on a point by point basis for pictorial display purposes. In this application it is critical to know how small and defined this point can be made, which will ultimately determine the resolution capability of such a light valve. This study analyzes the distribution of the deposited charge within the Potassium Di-deuterium Phosphate (D-KDP) crystal and its effect on the optical transmission. This is examined first by considering mathematical models with constant potential and also uniform current density distributions applied to the crystal surface. Secondly, experimental measurements are made on the optical distribution using an electron beam of measured current density distribution. The predicted and measured results with respect to maximum attainable optical resolution compared very closely. It can be concluded that the resolution capability of this display technique (up to 1000 lines) is not limited by the electro-optic or electrical characteristics of the bulk crystalline material. Author (TAB)

N69-29784*# National Aeronautics and Space Administration, Washington, D.C.
CONTRIBUTION TO THE STUDY OF GAS PUMPING BY A COLD WALL. ANISOTROPY OF THE MEDIUM. OPERATING PERIOD [CONTRIBUTION A L'ETUDE DU POMPAGE D'UN GAZ PAR UNE PAROI FROIDE. ANISTROPIE DU MILIEU. DUREE DE FONCTIONNEMENT]
E. Welby Jun. 1969 102 p refs Transl. into ENGLISH of French Rept. ONERA-NT-124
(NASA-TT-F-12259; ONERA-NT-124) Avail: CFSTI CSCL 20L

Recent developments in space simulation techniques make it necessary to obtain enormous pumping speeds, which can be reached by condensing the gases to be pumped on walls cooled to very low temperatures (cryopumping). After a literature survey, the validity of the conventional calculation of the pumping speed of a cryopump was considered on the basis of experimental results obtained with a setup of cylindrical geometry. The various results obtained in the free molecular domain are interpreted. Direct measurement of the temperature gradient in the deposit leads to a definition of the operating period over which cryopumping remains effective. Author

N69-29806# Cornell Univ., Ithaca, N.Y. Lab. of Atomic and Solid State Physics.
PHYSICS OF MANY PARTICLE SYSTEMS Ten Year Report, 1958-1968
Vinay Ambegaokar and John W. Wilkins Mar. 1969 16 p refs
(Contract Nonr-401(38))
(AD-685604; TR-31) Avail: CFSTI CSCL 20/12

The research supported by the contract falls naturally into five main categories: Statistical mechanics and magnetism; Lattice vibrations; Energy conversion; Superconductivity; and, Many body effects in metals. The report summarizes the main trends of the research and the results that have been achieved in each of these five areas. Published papers and Ph.D theses in each area are listed. TAB

N69-29899# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

ELECTRICAL CHARACTERISTICS OF THE EXPLOSION OF THIN METALLIC WIRE IN VACUUM

E. K. Chekalin et al 16 Oct. 1968 10 p Transl. into ENGLISH from Energ. Inst. Svoystva Gazov pri Vysokikh Temperaturakh; Fiz. Gazodinam., Termodinamika i Fiz. Goreniya (Moscow), 1967 p 110–113

(AD-685504; FTD-HT-23-944-68) Avail: CFSTI CSCL 20/3

A study was made of the electrical characteristics of an explosion of thin metallic wires. Aluminum and copper wires with diameters ranging from 0.11 to 0.3 mm were used in the experiments. Data regarding the electrical conductivity of metals corresponding to the phases of the metallic wire, i.e., the liquid and gaseous phases, were obtained by analyzing the characteristics of the exploding wires. Author (TAB)

N69-29914# Naval Research Lab., Washington, D.C. Electronics Div.

A THEORETICAL AND EXPERIMENTAL STUDY OF THE ac LOSSES OF A HIGH FIELD SUPERCONDUCTOR AND THE IMPLICATIONS FOR POWER APPLICATIONS

Donald J. Henrahan (Ph.D. Thesis) 26 Feb. 1969 68 p refs

(AD-686233; NRL-6820) Avail: CFSTI CSCL 20/3

A theory for the hysteresis loss of a high-field superconductor carrying ac is presented, based on the Riemersma critical state model (B x J = Ci. Voltage waveforms, energy loss per cycle, and limiting values of effective resistivity are derived. For sinusoidal current of frequency f in 10-mil wire the high (critical) current limit of resistivity is found to be 4.06 x 10 to the -14th power f (ohm-meter) compared to 0.93 x 10 to the -16th power f for a current peak of one-tenth the critical current; both values are independent of the high-field material used. An equivalent circuit consisting of a variable inductance is proposed for the hysteretic superconductor and three possible definitions of the inductance are discussed. In any case, the inductance is nonlinear, a transcendental function of the current, the function being different on the four segments of a hysteresis loop. The high-current limit of the absolute, internal inductance (the preferred definition) per unit length is mu sub zero/3 pi (henry/meter). Experiments were performed at 4.2K on bifilar windings of 10-mil, Nb25%Zr wire, both bare and copper plated. Currents up to the critical value were used at frequencies of 60, 400, and 800 Hz. The feasibility of applying superconductivity to two classes of ac power equipment is discussed: (1) conventional apparatus such as transformers and rotating machines, already highly efficient, and (2) low-voltage static inverters which are not so efficient. A novel circuit is presented for a superconducting inverter or oscillator. Author (TAB)

N69-29953# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

HYSTERISIS LOOPS OF IRON-GADOLINIUM FILMS, PLOTTED BY THE STATIC METHOD

V. A. Buravikhin et al 23 Jul. 1968 9 p refs Transl. into ENGLISH from Izv. Vyssh. Uchebn. Zaved., Fizika (Tomsk), v. 10, no. 7, 1967 p 137–139

(AD-684996; FTD-HT-23-417-68) Avail: CFSTI CSCL 20/3

The measurements were made with a magnetometer with transverse field, and the samples were annealed and non-annealed films with different compositions, ranging from 100% to 52% of iron. The films were evaporated from tungsten vessels in vacuum on glass substrates heated to 150C in a magnetic field of 50 Oe. The rate of film deposition was 500 A/min. The results revealed that such films exhibit all four types of hysteresis loops that were previously observed by K. A. Kuroyedov in permalloy films. The variations in the crystal-structure defects and in the coercive force occurring on going from each type of hysteresis loop to the other, and the dependence of these loops on the annealing temperature, are traced in detail. It is shown that the most useful films from the point of view of practical applications are those containing 20-33% Gd, since their coercive force is more uniform from sample to sample, the hysteresis loops are closest to the rectangular, and their magnetization is comparable with that of permalloy films. Author (TAB)

N69-30029# California Univ., Los Angeles. Dept. of Engineering.

EXACT SOLUTION TO THE ELLIPTICAL ACOUSTIC LENS PROBLEM

C. Yeh and D. Gish Feb. 1969 24 p refs

(Contract N00014-67-A-0111-0014)

(AD-684873; Rept-69-13) Avail: CFSTI CSCL 20/1

Rigorous solution to the wave equation for the penetrated and scattered fields of an underwater, elliptical cylindrical liquid lens that is illuminated by a line pressure source or by a plane pressure wave is obtained. Results are given in terms of Mathieu and modified Mathieu functions. It is found that each expansion coefficient for the scattered or penetrated pressure field is coupled with all expansion coefficients for the incident pressure field. Decoupling of these coefficients occurs when the elliptical cylinder lens degenerates to a circular cylinder lens. Also noted is the fact that the focal point for the intensity field does not always coincide with that for the pressure field. Author (TAB)

N69-30064# Federal Aviation Administration, Washington, D.C.

SONIC BOOM RESEARCH (1958–1968)

Johnny M. Sands Nov. 1968 23 p refs

(AD-684806) Avail: CFSTI CSCL 20/1

The United States Government has been actively engaged in sonic boom research since 1958 in an effort to learn more about this phenomenon and the means of controlling it. To this end, extensive testing has been done in the field as well as in the laboratory environment. This document is a brief history of sonic boom research. Part I presents a chronological listing of the various field research programs, identifies the Government agencies involved and provides a brief summary of the work accomplished. Part II describes some of the laboratory experiments and theoretical studies conducted under Government sponsorship. Part III contains a listing of publications resulting from these research programs and tells how these documents may be obtained. Author (TAB)

N69-30122 European Organization for Nuclear Research, Geneva (Switzerland). Institute de Physique Experimentale.

PHENOMENOLOGICAL ASPECTS OF SUPERCONDUCTIVITY

Jean Muller 5 May 1969 66 p refs

(CERN-69-9) Copyright. Avail: Issuing Activity

Lecture materials are documented on the following phenomenological aspects of superconductivity: London's electromagnetic description; properties of flux and fluxoid; thermodynamic properties; the Ginzburg–Landau phenomenological description and type 2 superconductors; state of a superconductor between H_c1 and H_c2; microscopic theory of superconductivity; Bardeen–Cooper–Schrieffer theory; superconducting materials; A_3B compounds and the Friedel–Labbe model; flux jumps; and stabilization with composite conductors. I.C.

N69-30175# Lincoln Lab., Mass. Inst. of Tech., Lexington.

DEMAGNETIZING FIELDS OF PLANAR MAGNETIC FILM STRUCTURES WITH ONE INFINITE DIMENSION

Robert Berger Repr. from IEEE Trans. Magnetics, v. MAG-4, no. 3, Sep. 1968 p 508–511 refs Presented at the INTERMAG Conf., Washington, D.C., 3–5 Apr. 1968

(Contract AF 19(628)-5167)

(AD-685690; MS-2185; ESD-TR-69-14). Copyright. Avail: CFSTI CSCL 9/2

Structures made of infinitely long planar strips of magnetic film whose infinite dimensions are all parallel are considered, and the field needed to magnetize them to a given extent normal to that dimension is specified. An exact analytic solution is given for partially saturated coplanar films. Some useful analytic approximations and a computer program are described for solving more general structures, including results for a sandwich of a current-carrying conductor between two parallel film strips.
Author (TAB)

N69-30208# Pennsylvania State Univ. University Park. Ordnance Research Lab.
AN INVESTIGATION OF ACOUSTIC PHASE-SHIFT NETWORKS IN THE DESIGN OF UNIDIRECTIONAL, UNDERWATER SOUND TRANSDUCERS
R. D. Marciniak Jan. 1969 70 p refs
(Contract NOw-65-0123)
(AD-684896; TM-409.3381-16) Avail: CFSTI CSCL 20/1

A low-frequency, underwater sound transducer model was developed which utilized a liquid-filled, acoustic phase-shift network to obtain a unidirectional (cardioid) directivity response over a prescribed frequency range. A number of analytical relationships between certain physical parameters of the device, its environment, and the acoustic phase shift network were studied to determine just how they should interact for the transducer to function as specified. A search was directed at finding and choosing an inert fluid which would satisfy the required acoustic phase-shift network parameters and also be relatively insensitive to a change in pressure (hence depth) and temperature. A study of the transducer design was carried out and a trilaminar, piezoceramic pressure-gradient element was selected in the final design of the model. When the completed transducer model was configured as specified, a unidirectional (cardioid) response was achieved consistently between 4000 Hz and 6000 Hz. Front-to-back discriminations ranging between 15 dB and 22 dB were recorded over the upper half of the frequency range (5000 Hz to 6000 Hz), while 10 dB to 15 dB discriminations were recorded over the lower half (4000 Hz to 5000 Hz) of the frequency range.
Author (TAB)

N69-30222# Michigan Univ., Ann Arbor. Cooley Electronics Lab.
THE EFFECT OF NOISE LEVEL UNCERTAINTY ON DETECTION PERFORMANCE: A COMPARATIVE STUDY
Ronald L. Spooner Mar. 1969 122 p refs
(Contract Nonr-1224(36))
(AD-685648; TR-196; Rept-3674-19-T) Avail: CFSTI CSCL 20/1

This report is concerned with the problem of detecting signals in noise of uncertain level. The impetus for this study is found in many areas; however, the detection of underwater sound signals in an ocean environment provides the primary motivation. The purpose is to consider the detection performance of a number of different receiver designs operating in an uncertain noise level environment. A number of receiver designs are considered ranging from the hypothetical externally sensed parameter (ESP) receiver to a standard cross-correlation type of receiver and including the clipper cross-correlator. The ESP receiver is a possibly non-realizable receiver whose performance serves as an upper bound while the cross-correlator is often used in practice. The design of the receivers investigated is briefly considered. The detection performance is displayed by means of receiver operating characteristic (ROC) curves for each receiver.
Author (TAB)

N69-30318# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
REVIEW OF THE CRYOGENICS SESSION: SECOND WEEK OF THE BROOKHAVEN SUMMER STUDY ON SUPERCONDUCTING DEVICES AND ACCELERATORS
T. R. Strobridge [1968] 11 p refs Repr. from Proc. of the 1968 Summer Study on Superconducting Devices and Accelerators, pt. 1, Apr. 1969 p 368-375
(R-5129; BNL-50155; C-55) Avail: CFSTI

Summaries of selected lecture topics of the cryogenics summer study program are presented. The topics were: (1) the low temperature mechanical properties of metallic structural materials, (2) properties of nonmetallic materials at cryogenic temperatures, (3) cryostat design, (4) cryopumping, (5) cryogenic electrical leads, (6) cryogenic safety, (7) superfluid helium as a refrigerant, (8) heat transfer to helium 1, (9) refrigeration, (10) the European state of the art, and (11) refrigeration for superconducting magnets in the 200 GeV accelerator, Weston, Illinois. It is concluded that there are a number of metals which may be safely used for structural load bearing, and that further research should be accomplished in electrical leads, as the lead design affects cryostat design and refrigeration requirements.
F.O.S.

N69-30359# Eidgenossische Technische Hochshule, Zurich (Switzerland).
GENERALIZED CANONICAL TRANSFORMATION FOR REPRESENTING KEPLER MOTIONS ON HARMONIC OSCILLATORS, AND APPLICABLE PERTURBATION THEORY [VERALLGEMEINERTE KANONISCHE TRANSFORMATIONEN ZUR ABBILDUNG VON KEPLERBEWEGUNGEN AUF HARMONISCHE OSZILLATOREN UND ZUGEHOERIGE STOERUNGSTHEORIE]
Gerhard Scheifele (Ph.D. Thesis) 1968 108 p refs In GERMAN
(Diss-4212) Avail: CFSTI

The Hamiltonian canonical theory of mechanics is modified and used to analyze the relationship between celestial mechanics and the theory of oscillations. The generalized Levi-Civita transformation is formulated into a canonical system consisting of 10 first order differential equations to determine 5 pairs of conjugated variables that include those perturbing forces that cannot be derived from a potential. Application of the Jacobian theory to this 10-dimensional phase-space leads to a system of 10 elements and further numerical or analytical integration. Thus, the canonical formulation provides a base for the treatment of analytical perturbation theories.
Author

N69-30360*# Virginia Polytechnic Inst., Blacksburg.
INFRARED ABSORPTION DUE TO IMPURITIES AND RADIATION DAMAGE IN SEMICONDUCTORS Final Report
T. E. Gilmer, Jr. Mar. 1969 9 p refs
(Grant NGR-47-004-006; VPI Proj. 313176)
(NASA-CR-101691; SAPR-8) Avail: CFSTI CSCL 20F

Optical measurements on donor and acceptor states of lithium and lithium-oxygen complexes in silicon, and on radiation effects in silicon semiconductors are reported. Lithium-doped silicon crystals pulled from quartz crucibles have oxygen concentrations of the order of 10^{17} to 10^{18} cm^{-3} and higher, whereas float-zone obtained crystals exhibit no evidence of lithium-oxide spectra; it is assumed that the oxygen either diffuses or is reduced to such a small concentration that it is spectrally difficult to determine. Electron paramagnetic resonance spectra of low temperature irradiated silicon samples confirm the mobility of interstitials in silicon under cryogenic conditions. Attempts to induce an optical absorption attributable to the lithium-damage-center complex in silicon are unsuccessful.
G.G.

N69-30378# Lockheed Missiles and Space Co., Palo Alto, Calif.
OPTICAL PROPERTIES OF HOT AIR. PART 1: FUNDAMENTAL PROCESSES AND SPECTRUM CHARACTERISTICS

I. V. Avilova et al. [1969] 23 p refs Transl. into ENGLISH from J. Quant. Spectro Radiat. Transfer (London), v. 9, 1969 p 89–111
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

The optical properties of hot gases are analyzed, taking into account the structure of the real spectrum. Fundamental radiation processes and methods for computing their cross sections are considered. Values are obtained for individual process cross sections and the resultant spectrum absorption coefficient in a 250 to 150,000 cm^{-1} range, with a 250 cm^{-1} spacing. Comparisons with experimental results are made; and the role of individual elementary processes is analyzed, particular attention being paid to the effects of the spectral lines. A.C.R.

N69-30379# Lockheed Missiles and Space Co., Palo Alto, Calif.
OPTICAL PROPERTIES OF HOT AIR. PART 2: INTEGRAL CHARACTERISTICS 4000-20000°K
I. V. Avilova et al [1969] 11 p refs Transl. into ENGLISH from J. Quant. Spectr. Radiat. Transfer (London), v. 9, 1969 p 113–122
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Integral characteristics of high temperature air for use in solving various radiation transfer problems are derived. The degree of blackness, and Rosseland and Planc means are examined in particular. The entire spectral band in which the major portion of radiant energy transfer occurs is taken into account, and a method is developed and computations made for hot air in the region 4000° to 20,000°K, 0.001 to 100 atm, and 1 to 300 cm layer thickness. Included are the integral characteristics for both the whole spectrum and for 10 spectral bands. The computational results are presented in tabular form, and comparison is made with experimental results. A.C.R.

N69-30398# Harvard Univ., Cambridge, Mass. Div. of Engineering and Applied Physics.
EXCITATION OF MULTIPLE MAGNON BOUND STATES IN ANISOTROPIC LINEAR CHAINS
Jerry B. Torrance, Jr. Jan. 1969 215 p refs
(Contracts Nonr-1866(58); ARPA SD-88; Grant NSF GP-6787)
(AD-685895; TR-1) Avail: CFSTI CSCL 20/12

The CO(++) spins in metamagnetic $COCl_2 \cdot 2H_2O(CC2)$ form ferromagnetic (FO) linear chains. Below 17.2K these FO chains are ordered in either an antiferromagnetic (AF), ferrimagnetic (FI), or ferromagnetic (FO) phase, depending on the magnitude of the applied field. Far infrared measurements performed on CC2 reveal absorption which is identified as AF resonance, FI resonance, and FO resonance in the respective phases. Furthermore, these magnons appear to interact with an unexpected excitation which is believed to be an optical phonon. The observed frequencies of both the phonon and the magnetic resonances are well described by a conventional spin wave calculation (with an anisotropic exchange interaction) and a phenomenological magnon-phonon coupling. Perhaps the most striking feature of the data, however, is the appearance of absorption in each phase having Zeeman energies corresponding to G-values of about 14, 21, 28, and even 35, in addition to the normal spin waves which have a g-value of approx. 7. Furthermore, the energy of an N-fold multiple excitation is markedly less than N times the energy of a single one. These excitations are called spin clusters or magnon bound states, and this is the first direct observation of these excitations. In order to account for the deviations of the experimental data from the predictions of the Ising (U) model, a general theoretical method is developed. Author (TAB)

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N69-29012# Pittsburgh Univ., Pa. Wharrett Lab. of Nuclear Chemistry.
NUCLEAR CHEMISTRY RESEARCH: RECOIL STUDIES OF NUCLEAR REACTIONS Annual Report, Jan. 1968–Jan. 1969
Robert L. Wolke Jan. 1969 39 p refs
(Contract AT(30-1)-2771)
(NYO-2771-29) Avail: CFSTI

The pre-equilibrium charge states of recoils from the reactions $^{12}C(d,d)^{12}C$ and $^{12}C(d,\alpha)^{10}B$ were investigated, and the angular distributions of recoils from the reactions $^{12}C(d,n)^{13}N$ and $^{6}Li(d,n)^{7}Be$ at deuteron energies of 12, 15, and 17 MeV were measured. The search for beta instability of ^{110}Cd was revived following the acquisition of a Sharp Low Beta II counter. NSA

N69-29026# United Kingdom Atomic Energy Authority, Harwell (England).
STRUCTURE IN SUB-THRESHOLD FISSION MODES
J. E. Lynn Sep. 1968 61 p refs
(AERE-R-5891) Avail: CFSTI; HMSO 8s

The available experimental evidence for gross structure in subthreshold fission is summarized, and a theoretical interpretation of the narrow intermediate structure observed in resonance cross sections is developed. An analysis of data on narrow intermediate structure is outlined, and damping and coupling parameters are discussed in terms of the double minimum in the potential energy of deformation calculated by Strutinsky in theoretical studies of shell effects in the deformation energy of nuclei. NSA

N69-29033 Northwestern Univ., Evanston, Ill.
A CONTINUOUS CHARGED SPHERE MODEL OF MOLECULAR STRUCTURE
Bryant Hawk Prentice, III (Ph.D. Thesis) 1968 109 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-1914

The complexities in obtaining accurate solutions to the Schrödinger equation make it desirable to have models which will predict correct structure of molecules. Such a model is proposed consisting of continuous charged spheres. Spherical Gaussians are used to represent a pair of electrons either in an inner shell, a lone pair, or a bond pair. An energy expression is first formulated assuming the orbitals have zero differential overlap. An auxiliary term consisting of the resonance potential integrals is added to the energy expression in order to take into account the effect of overlap. A complete minimization of this energy expression is used to predict the equilibrium geometry. Results for the first row hybrids are satisfactory for molecules which have no lone pairs. The bond lengths are correct within 10%. The model does indicate that perhaps a quantum mechanical energy expression may give worthwhile results. Dissert. Abstr.

N69-29063# United Kingdom Atomic Energy Authority, Harwell (England).
CONFERENCE ON LOW AND MEDIUM ENERGY NUCLEAR PHYSICS AT AERE, HARWELL, 27–29 MARCH 1968
W. M. Currie, ed. Mar. 1968 83 p refs Conf. held at AERE, 27–29 Mar. 1968
(AERE-R-5744; Conf-680321) Avail: CFSTI

Outlines of contributed papers and invited talks dealing with resonance reactions; gamma spectroscopy; techniques, aparatus, and instrumentation; nuclear spectroscopy; theoretical topics; medium-energy work; computer programs; and testing of cosmological theories are presented. NSA

N69-29094# Naval Research Lab., Washington, D.C.
COSMIC X-RAYS Progress Report
H. Friedman Jan. 1969 37 p refs
(PB-182640) Avail: CFSTI CSCL 03B

Contents: Cosmic X-rays; Trans-Atlantic flight tests of the NRL Mark 3 Omega aircraft receiver; Acoustics; Atmosphere and astrophysics; Chemistry; Communications sciences; Metallurgy; Ocean Technology; Rader. USGRDR

N69-29098# Brookhaven National Lab., Upton, N.Y.
COEFFICIENTS OF ANGULAR CORRELATION OF DIPOLE AND QUADRUPOLE GAMMA TRANSITIONS
G. A. Labov [1968] 11 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Fiz. (Moscow), no. 32, 1968 p 886–891
(BNL-tr-246) Avail: CFSTI

Simple analytical expressions for the coefficients of various angular correlations in case of dipole and quadrupole γ transitions in nuclei, with arbitrary spins of nuclear states, are derived. Some properties of the Clebsch–Gordan, Fano, and Racah coefficients are used. With the analytical expressions obtained for the coefficients, one can calculate angular correlations in a more simple way, and there is no necessity to use numerical tables for these coefficients. Author (NSA)

N69-29103# Florida State Univ., Tallahassee. Dept. of Physics.
RESEARCH IN EXPERIMENTAL AND THEORETICAL LOW ENERGY NUCLEAR PHYSICS Final Report, 1 Oct. 1967–30 Sep. 1968
Robert H. Davis and Norman P. Heydenburg Feb. 1969 72 p refs
(Grant AF-AFOSR-440-67)
(AD-684735; AFOSR-69-0421TR) Avail: CFSTI CSCL 20/8

Summaries of the work performed during the past year by six research groups are presented. The investigations of nuclear reactions and nuclear structure include studies of isobaric analogue states, interactions between complex nuclei, single and multiple nucleons transfer reactions, systematics of the f sub 7/2 shell, Coulomb excitation, level scheme determination by observation of short live activities, and meson induced charge-exchange reactions. Also included is a report on preliminary research in molecular collision physics. Indirect support is provided for a nuclear chemistry research, the results of which are cited herein. Facility improvements are discussed especially in the categories of ion source development and data handling by means of an on-line computer. TAB

N69-29110# Westinghouse Electric Corp., Pittsburgh, Pa. Astronuclear Lab.
CALCULATION OF THE TWO PHONON COHERENT NEUTRON SCATTERING CROSS SECTION FOR SINGLE CRYSTAL BERYLLIUM IN THE HARMONIC APPROXIMATION
A. S. Johnston 26 Jan. 1968 24 p refs Presented at the Symp. on Inelastic Neutron Scattering, Copenhagen, 20–24 May 1968
(Conf-680501-6) Avail: CFSTI

A calculation of the two phonon coherent neutron scattering cross section for single crystal beryllium in the harmonic approximation was done. The calculation was performed by approximating the sums over eigenmodes by sums in which the terms are evaluated at mesh points in the first Brillouin zone. The Born-von Karman model of deWames, Wolfram, and Lehman for beryllium is used. Results are obtained as a histogram giving the scattering law for fixed neutron wave vector change versus the neutron energy transfer. Author (NSA)

N69-29112# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Neutron Physics.
METHOD OF RECIPROCAL GEOMETRY FOR PHOTON INVESTIGATION USING THE JINR IBR
E. Malishevski, T. A. Machekhina, V. V. Nitts, and Pak Gvan O 1969 7 p refs In RUSSIAN
(JINR-P14-4270) Avail: AEC Depository Libraries

The phonon measuremonts in the "reciprocal" geometry, performed by the time-of-flight method, are described. The measurements were performed using the pulsed fast reactor of the Joint Institute for Nuclear Research. Some neutronograms, obtained in the experiments with the Cu, Al, and Bi single crystals, are given. Author (NSA)

N69-29121 Illinois Univ., Urbana.
DOUBLE RESONANCE STUDIES OF NUCLEAR SPIN RELAXATION
John Robert Hansen (Ph.D. Thesis) 1968 76 p
Avail: Univ. Microfilms: HC $4.20/Microfilm $3.00 Order No. 69-1352

The equations describing the relaxation of the nuclear magnetism for liquid solutions containing two nuclear spin species have been derived, with an explicit form for the concentration dependence of the relaxation rates. The solutions of these equations have been obtained for various initial conditions (double resonance 180 degree pulse-recovery, transient and steady-state nuclear Overhauser effect). A simple modular system for modifying a high-resolution nuclear magnetic resonance spectrometer for pulsed operation was used for the relaxation rate determinations. The experimental results obtained for the chloroform-trichlorofluoromethane system were found to be consistent with the solutions of the relaxation equations. Dissert. Abstr.

N69-29151# Los Alamos Scientific Lab., N.Mex.
SOME PHYSICS USES OF LAMPF: 1968 SUMMER STUDY GROUP AT LOS ALAMOS
Peter A. M. Gram, ed. 16 Jan. 1969 56 p refs Revised
(Contract W-7405-eng-36)
(LA-4080) Avail: CFSTI

A summary of 30 talks presented at the 1968 Summer Study Group on Physics Uses of LAMPF is presented. These talks include recent developments in elementary particle physics, proposed experimental facilities for LAMPF, and proposals for experiments to be performed at LAMPF. NSA

N69-29158 Illinois Univ., Urbana.
TH EFFECTS OF QUADRUPOLE RELAXATION ON HIGH RESOLUTION AND PULSED NMR
Ernest Stanley Gore (Ph.D. Thesis) 1968 84 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 69-1348

An investigation has been carried out of the effects of quadrupole relaxation in molecules containing a group of magnetically equivalent spin-1/2 nuclei bound to a quadrupolar nucleus using steady state high resolution and pulsed (spin echo) NMR techniques. It is shown how the two methods complement each other, the spin echo method being more favorable for determining the spectral parameters when the quadrupole relaxation is fast and the high resolution method being used for slow or intermediate rates of quadrupole relaxation. Dissert. Abstr.

N69-29247*# Techtran Corp., Glen Burnie, Md.
INJECTION AND TEMPORARY CAPTURE OF A CHARGED PARTICLE BEAM IN AN OPEN MAGNETIC CONFIGURATION. OPTIMIZATION OF THE CONFIGURATION. CASE OF CYLINDRICAL SYMMETRY: A MIRROR MACHINE [ETUDE DE L'INJECTION ET DE LA CAPTURE TEMPORAIRE D'UN FAISCEAU DE PARTICULES CHARGEES DANS UNE CONFIGURATION MAGNETIQUE OUVERTE. OPTIMISATION DE LA CONFIGURATION. CAS DE LA SYMETRIE DE REVOLUTION: MACHINE A MIROIRS]
Pierre Capdequi-Peyranere Washington NASA Jun. 1969 78 p Transl. into ENGLISH from French Rept. CEA-R-3197; EUR-3437 (Contract NASw-1695)
(NASA-TT-F-12235; CEA-R-3197; EUR-3437) Avail: CFSTI CSCL 20H

A new method of transverse injection of charged particles into a magnetic mirror configuration permits the penetration and temporary capture by nonadiabatic effect of a particle beam of approximately 1 cm cross section. The original programs for IBM 7094 computer calculations were used to obtain an optimization of the configuration. The results of a statistical study of the optimum configuration indicate that, if the energy of the beam particles is about 1% greater than a minimum penetration energy, the entire beam can be captured with an average capture length of 100 meters. If the energy is about 4% greater than the minimum penetration energy, the capture length is reduced to 40 meters. The distribution of energy transverse and longitudinal with the magnetic field for the population of captured particles was studied. Author

N69-29280 Oregon Univ., Portland.
STUDIES IN PRACTICAL PERTURBATION TECHNIQUES: THEIR DEVELOPMENT AND APPLICATION TO THE CALCULATION OF THE GROUND STATE ENERGY OF BERYLLIUM
Tery Lynn Barr (Ph.D. Thesis) 1968 116 p
Avail: Univ. Microfilms: HC $5.60/Microfilm $3.00 Order No. 69-3

The first efforts of the study were to circumvent an overcompleteness problem inherent in the basis set of a previous perturbation study of the Be atom. This was accomplished by expanding a trial function in terms of a complete discrete set, and using the Rayleigh–Ritz method over the hydrogenic Hamiltonian to get a new basis set. A unique spectral partitioning of the Hamiltonian was developed and this led to a novel perturbation technique related to a truncated form of the Feenberg perturbation method. In order to improve these results, a technique called consolidated variation perturbation or Configuration Interaction–Perturbation Theory (CI-Pert), consists of performing an initial CI-variation calculation on selected configurations, and then finishing the calculation with second order perturbation theory. The variation study was done on the major contributing configurations. Dissert. Abstr.

N69-29295# Joint Inst. for Nuclear Research, Dubna (USSR).
EFFECT OF THE HEXADECAPOLE DEFORMATION ON THE PROPERTIES OF ONE-QUASI-PARTICLE STATES OF THE RARE-EARTH NUCLEI
F. A. Gareev, S. P. Ivanova, N. Yu. Shirikova 1969 22 p refs In RUSSIAN
(JINR-P4-4259) Avail: AEC Depository Libraries

The effect of the β_{40} deformation on the properties of one-quasiparticle states of the rare-earth nuclei is investigated. It is shown that a number of characteristics, such as the local level density, the decoupling parameters, and the interval of the level quasi-intersection, are changed, depending on the hexadecapole deformation value. Author (NSA)

N69-29296# General Electric Co., St. Petersburg, Fla. Neutron Devices Dept.
ELECTRON FOCUSING BY AN ION BEAM
J. H. Terhune 22 Oct. 1968 20 p refs
(Contract AT(25-2)-868)
(GEPP-49) Avail: CFSTI

The effect of ionic space-charge on secondary electron current density in a uniform accelerating space is computed using a model that neglects electronic screening and nonuniformities in the accelerating field. For sufficiently large ion current and/or sufficiently small electron temperature, a radial nonuniformity can develop in an initially uniform electron current density. This effect manifests itself in focusing of the secondary electrons on the ion source aperture. The magnitude of the electron focusing is calculated for two physical cases. Author (NSA)

N69-29313# Institute of Nuclear Research, Warsaw (Poland).
LITHIUM AND BERYLLIUM NUCLEI EMITTED DURING THE THERMAL NEUTRON FISSION OF U-235
J. Blocki, J. Chwaszczewska, M. Dakowski, T. Krogulski, E. Piasecki et al 1968 13 p refs
(INR-P-952) Avail: AEC Depository Libraries

The energy spectra and relative yields of lithium and beryllium nuclei emitted during the thermal neutron fission of ^{235}U were investigated using a two-counter telescope with a proportional counter as the ΔE detector. An attempt was made to compare the experimental results with model calculations. Author (NSA)

N69-29314# California Univ., Berkeley. Lawrence Radiation Lab.
DETECTION OF NMR BY NUCLEAR RADIATION
D. A. Shirley Jul. 1968 41 p refs Presented at the 15th AMPERE Colq., Grenoble, France, 16–21 Sep. 1968 Submitted for publication
(Contract W-7405-eng-48)
(UCRL-18315; Conf-680901-2) Avail: CFSTI

A description is given of some of the more important features of the various experiments known collectively as NMR/RD (radiative detection of NMR). NMR/RD is contrasted with conventional NMR to emphasize their essential differences. A unified theoretical description of NMR/RD is briefly described. Experimental results are discussed. NSA

N69-29315# California Univ., Livermore. Lawrence Radiation Lab.
PHENOMENOLOGICAL ANALYSES OF (p,p) AND (n,p) DATA UP TO 750 MeV
Malcolm H. MacGregor Jun. 1968 18 p refs Presented at the Meeting on Nucleon-Nucleon and Pion-Nucleon Interactions, Dubna, USSR, 11–15 Jun. 1968 Sponsored by AEC
(UCRL-71145; Conf-680646-1) Avail: CFSTI

A phase-shift analysis of the available (p,p) and (n,p) scattering data in the energy region below 750 MeV was performed. Energy-dependent analyses were carried out in the energy ranges from 0 to 400 MeV and from 0 to 750 MeV. Single-energy analyses were carried out in narrow energy bands centered at 25, 50, 98, 142, 210, 330, 425, and 630 MeV. Author (NSA)

N69-29316# California Univ., Berkeley. Lawrence Radiation Lab.
POLARIZATION IN PROTON-HELIUM SCATTERING AT 70 AND 80 MeV
Albert W. Stetz (Ph.D. Thesis) Dec. 1968 82 p refs
(Contract W-7405-eng-48)
(UCRL-18088) Avail: CFSTI

A helium-filled streamer chamber was used to observe the scattering of protons in gaseous helium. With an image intensifier and special high-voltage equipment, consistently good photographs were obtained over many hours of operation. The system made possible good resolution, in the projection mode, of tracks which differed greatly in ionization density. Since the gas

in the streamer chamber was used as the scattering target, vertices involving very low-energy particles were observed. The analyzing power in p + ^{4}He elastic scattering was measured at 70-and 80-MeV incident proton energy. With this data, as well as that at 96 MeV and lower energies, the polarization at forward angles is essentially determined from zero to 96 MeV. The forward polarization peak, which increases with increasing energy above 70 MeV, makes helium an attractive analyzer for polarized nucleons at these energies. Author (NSA)

N69-29342# Institute of Nuclear Research, Warsaw (Poland).
RADIATION DAMAGE IN p-TYPE GERMANIUM AT LOW TEMPERATURES [USZKODZENIA RADIACYJNE W GERMANIE TYPU P W NISKTICH TEMPERATURACH]
Z. G. Werner (Reading Univ.) and J. E. Whitehouse (Reading Univ.) 1968 27 p refs
(INR-934) Avail: AEC Depository Libraries

The effect of infrared light illumination and annealing in the temperature range 4 to 120°K on the resistivity of degenerate, gallium- and oxygen-doped p-type germanium irradiated with 2-MeV electrons at liquid-helium temperature was studied. Two types of minority carrier traps were observed. One of them annealed in the temperature range 40 to 80°K, while the other was stable up to 120°K. No effect of oxygen doping on the properties of the traps was found. The results of the experiment can be qualitatively understood on the basis of a model assuming that the germanium interstitial atom is mobile at liquid helium temperature and forms complexes with neutral impurity atoms. Author (NSA)

N69-29343# Oak Ridge National Lab., Tenn.
HIGH-ENERGY MUON TRANSPORT AND THE MUON BACKSTOP FOR A MULTI-GeV PROTON ACCELERATOR
R. G. Alsmiller, Jr. and J. Barish Mar. 1969 19 p refs
(Contract W-7405-eng-26)
(ORNL-4386) Avail: CFSTI

High-energy muon transport calculations are presented and the shape of the muon backstop required for a 200- and a 500-GeV proton accelerator is determined. The shield material considered is heavy concrete. Results obtained with an energy-dependent and an energy-independent stopping power are presented and compared. The error introduced by using a constant stopping power is clearly evident, but it may be tolerable for some design purposes. Author (NSA)

N69-29344# California Univ., Berkeley. Lawrence Radiation Lab.
ISOSPIN STRUCTURE OF PAIRING VIBRATIONS
Bent Sorensen Jan. 1969 8 p Presented at the Conf. on Isobaric Spin, Pacific Grove, Calif., 13–15 Mar. 1969
(Contract W-7405-Eng-48)
(UCRL-18715; Conf-690310-2) Avail: CFSTI

The possible existence of an isospin structure in collective pairing-type excitations is discussed in connection with the confrontation of experimental data and a reliable pairing force calculation which neglects isospin structure. Evidence for the isospin structure suggested by Bohr is found in C, Mg, Si, Ti, and Ni isotopes. Author (NSA)

N69-29348 Tennessee Univ., Knoxville.
ELECTRON ATTACHMENT TO ORGANIC MOLECULES
Robert Philip Blaunstein (Ph.D. Thesis) 1968 124 p
Avail: Univ. Microfilms: HC $6.00/Microfilm $3.00 Order No. 69-1232

An apparatus has been built for the measurement of the rates of electron attachment to molecules in the gas phase in the temperature range from 28° to 210°C. The design, construction, and pressure measuring devices associated with this apparatus have been modified with respect to those used in previous experiments of this type. These modifications allowed the present attachment studies for molecules which are in the crystalline form at 25°C and thus exhibit low vapor pressures. Electron attachment rates and mean electron attachment cross sections as a function of mean electron energy for dissociative attachment to the aliphatic compounds CH_2Cl_2, $CHCl_3$, CCl_4, $1,1,1-C_2H_3Cl_3$, $1,1,2-C_2H_3Cl_3$, and C_3HCl_5 are measured directly using the constructed equipment and mean electron attachment cross sections are calculated for sixteen additional aliphatic hydrocarbons from previously known attachment rates. Dissert. Abstr.

N69-29353# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
PROPERTIES OF ATOMIC NUCLEI AND INTERACTION BETWEEN NUCLEONS
G. F. Filippov 1968 12 p refs In RUSSIAN; ENGLISH Summary
(ITF-68-66) Avail: AEC Depository Libraries

The problem of whether it is possible to explain the saturation observed in atomic nuclei (when coupling energy and volume are proportional to the number of nucleons) by considering only pair forces without a hard core is considered. The answer is negative. The saturation can be explained by introducing either hard-core or three-particle repulsive forces. Author (NSA)

N69-29354# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
STOCHASTIC MOTION OF A RELATIVISTIC PARTICLE
N. A. Chernikov 1968 148 p refs In RUSSIAN; ENGLISH summary Presented at Conf. on Composite Models of Elementary Particles, Kiev, Jun. 1968
(ITF-68-44; Conf-680647-2) Avail: AEC Depository Libraries

The problem of stochastic motion of a particle is formulated so that the world time plays no special role but the proper time of the particle appears to be important. This allows one to write down the relativistic kinetic equation. The problem of relativistic collision integral turns out to be a particular case of the general problem. For representation of quantities which enter the collision integral the theory of relativistic particles scattering is developed in terms of the Lobachevsky velocity-space. Some problems of penetration of relativistic particles through the matter are formulated and solved. Author (NSA)

N69-29358# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
PRODUCTION OF NUCLEI WITH MASS NUMBERS A EQUALS 2–4 IN COLLISIONS OF HIGH ENERGY PARTICLES WITH THE COMPLEX NUCLEI (MAIN EXPERIMENTAL RESULTS AND THEIR INTERPRETATION)
S. M. Elisseev 1969 34 p refs In RUSSIAN
(JINR-P2-4258) Avail: AEC Depository Libraries

Experimental data on the production of deuterons, tritons, and α particles in collisions of particles with nuclei are reviewed. Different models of light nuclei production (Butler–Pearson model, fluctuation model etc.) are also considered. Author (NSA)

N69-29369# California Univ., Livermore. Lawrence Radiation Lab.
SORS MONTR CARLO NEUTRON-TRANSPORT CODE FOR THE CDC-6500
John Kimlinger and Ernest F. Plechaty 24 Oct. 1968 29 p Sponsored By AEC
(UCRL-50832) Avail: CFSTI

The SORS Monte Carlo neutron-transport code is a two- or three-dimensional program for calculating the transport of neutrons in the energy range from thermal to 14.8 MeV. Author (NSA)

N69-29370# Sandia Corp., Albuquerque, N.Mex.
CORRELATED NEUTRONS IN A SIMPSON PILE
Bernhard Meyer (Ph.D. Thesis--Munich Univ., May 1961) 28 Feb. 1969 51 p refs Sponsored by AEC
(SC-T-69-1009) Avail: CFSTI

Two neutron counters (standard Simpson Pile) were used to measure the low-energy nucleon component of cosmic radiation, and for this purpose the correlation of the recorded evaporation neutrons was examined. By means of multiplication, there occur on the average 1.25 neutrons for the Munich apparatus, while the apparatus at the Zugspitze mountain showed 1.30 neutrons. The variance of this multiplication was determined at about 0.54. This, as well as the variance of the triggering nucleons distributed according to Poisson, determines a minimum standard deviation of the counting sum. The latter agrees with the standard deviation as ascertained by the comparison of hourly values of both halves of the apparatus. Consequently, it is not possible to demonstrate a contribution of apparatus fluctuations within a comparative space of one hour each. It becomes apparent that the fluctuation of the dead time considerably affects the counting precision for counting times of one day and longer. It is proposed to reduce the relative standard deviation by prolonging the dead time up to the order of magnitude of the diffusion time, i.e., from the customary 5 or 10 μsec up to about 200μsec. In such a case, the multiplication is suppressed and, moreover, the influence of the dead time variation on the standard deviation becomes minimal. Author (NSA)

N69-29376# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
STRONG COUPLING, CALCULATION OF BOUND STATES
I. V. Simenog 1968 15 p refs In RUSSIAN; ENGLISH summary
(ITF-68-45) Avail: AEC Depository Libraries

The physical characteristics of bound states of the two-body problem are studied depending on the coupling constant g (and large g). The problem of bound states of systems with a small number of nucleons is considered. Author (NSA)

N69-29378# Gosudarstvennyi Komitet po Ispolzovaniyu Atominoi Energii, Serpukhov (USSR). Inst. Fiziki Vysokikh Energii.
SYSTEM FOR THE INJECTION OF PARTICLES INTO THE PROTON SYNCHROTRON IHEP AT ENERGY 70 GeV
S. N. Boiko, V. I. Zaitsev, E. A. Myae, I. M. Rolfe, and B. A. Stekol'nikov 1968 31 p refs In RUSSIAN
(IFVE-SKU-68-48-K) Avail: AEC Depository Libraries

The problems connected with the design and adjustment of the injection system of the 70 GeV proton synchrotron are discussed. Some considerations connected with injection of the beam into the accelerator, demands to the system characteristics, and the results of the adjustment and work with the beam are given. Author (NSA)

N69-29377# Brookhaven National Lab., Upton, N.Y.
SPECIFICATION AND CHARACTERIZATION OF NEUTRON DATA
Murrey D. Goldberg Feb. 1969 21 p Presented at IAEA Panel on Neutron Data Compilation, Upton, N.Y., 10--14 Feb. 1969
(BNL-13257; CONF-690204-1) Avail: CFSTI

The proposed content of the data storage system OSIRIS, which is being developed at Brookhaven, is outlined. The specification and characterization of neutron interactions are discussed at length. NSA

N69-29378# Akademiya Nauk URSR, Kiev. Inst. Teoreticheskoi Fiziki.
THE EFFECT OF THE RELATIVISTIC QUARK MOTION IN MESONIC DECAYS
E. V. Struminskii 1968 7 p refs In RUSSIAN Presented at the Conf. on Composite Models of Elementary Particles, Kiev
(ITF-68-48; Conf-680647-4) Avail: AEC Depository Libraries

The well-known Kawarabayeshi–Suzuki relation $g_{\rho\gamma} = f_\pi m_\rho$ is obtained using the quasi-independent quark model which takes into account the relativistic effects. Author (NSA)

N69-29380# Australian National Univ., Canberra. Research School of Physical Sciences.
ON THE EFFECT OF THE STATISTICAL COMPOUND NUCLEUS PROCESS IN ELASTIC SCATTERING MEASUREMENTS
P. J. Dallimore 1969 8 p refs
(ANU-P-424) Avail: AEC Depository Libraries

The errors in elastic scattering cross-section calculations due to a statistical compound-nucleus component are investigated. It is found that the spin of the target nucleus is a major parameter in the estimation of these errors. Author (NSA)

N69-29384 Utah State Univ., Logan.
A MEASUREMENT AND ANALYSIS OF OPTICAL EMISSIONS RESULTING FROM 20 TO 100-keV PROTON-NITROGEN COLLISIONS
Harold Arthur Birk Gardiner (Ph.D. Thesis) 1968 183 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 69-1070

Absolute cross sections for excitation of the N_2^+ first negative bands in collisions of 20- to 100-keV protons with N_2 have been measured under single collision conditions. The cross sections are found to extrapolate very well to recent electron impact data at proton energies above 550 keV. On the basis of a charge-exchange model which predicted the observed variation of intensity with pressure, emission cross sections for the (0,0) λ3914 Å N_2^+ first negative band and the (0,2) λ3806 Å N_2 second positive band were obtained for hydrogen atom impact and the sum of the cross sections for electron capture and loss were found for hydrogenic particles traversing N_2. The latter cross sections are in good agreement with those measured by charge collection methods. Dissert. Abstr.

N69-29402# Stanford Linear Accelerator Center, Calif.
ANALYSIS OF MUON HYDROGEN BUBBLE CHAMBER EXPERIMENTS
Martin L. Perl Dec. 1968 8 p refs
(Contract AT(04-3)-515)
(SLAC-92) Avail: CFSTI

Basic data for the consideration of muon exposures in liquid hydrogen bubble chambers at the Stanford Linear Accelerator Center for studying muon + proton inelastic reactions are presented. The improvement in the data rate by using a very large hydrogen bubble chamber is shown. The relevant properties of the SLAC muon beam are discussed, and the inelastic event rate to be expected in a SLAC bubble chamber is given. The event rate is given for a very large hydrogen bubble chamber. Author (NSA)

N69-29405# Columbia Univ., New York.
THREE-BODY CALCULATIONS WITH LOCAL POTENTIALS
D. D. Brayshaw [1968] 59 p refs Sponsored by AEC
(NYO-1932(2)-146) Avail: CFSTI

A two-term separable approximation to the two-particle t-matrix is developed which preserves exact behavior at each bound state or resonance pole. While introducing no additional singularities, the approximation also produces the exact right-hand cut. This separable approximation is applied to the three-particle scattering problem with local potentials, and numerical results are obtained for the three body binding energy in the case of the Yukawa and exponential potentials. A prescription is given for increasing the accuracy of this approach by systematically increasing the number of separable terms. This procedure is tested numerically, as is a method for estimating the error in such calculations.

Binding energy results are also presented for a modified pole approximation, and a simple explanation is given for the infinite binding energy phenomenon observed by Osborn for separable potentials. Author (NSA)

N69-29404# California Univ., Livermore. Lawrence Radiation Lab.
ASTRON LINEAR ACCELERATOR
J. W. Beal, N. C. Christofilos, and R. E. Hester 20 Feb. 1969 6 p refs Presented at Particle Accelerator Conf., Washington, D.C., 5–7 Mar. 1969 Supported by AEC
(UCRL-71405; CONF-690308-2) Avail: CFSTI

The design and operation of the 4.2-MeV, 800-A induction-type electron linear accelerator for the Astron thermonuclear reactor experiment are discussed. NSA

N69-29418# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
FIELD AND PARTICLES IN NONLOCAL POTENTIAL MODEL
V. E. Trotskii 1968 12 p refs In RUSSIAN; ENGLISH summary Presented at 2nd Conf. on Axiomatical Field Theory and Theory of Elementary Particles, Kiev, Apr. 1968
(ITF-68-26; CONF-680453-21) Avail: AEC Depository Libraries

In the framework of the model with a nonlocal separable potential and in the nonrelativistic Lie model some relations are established between matrix elements of a scalar field and the S-matrix on the mass shell. Author (NSA)

N69-29419# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
SOME CANONICAL TRANSFORMATIONS OF QUANTUM FIELD THEORY AND STATISTICAL MECHANICS
O. I. Zavyalov and V. N. Sushko 1968 19 p refs In RUSSIAN; ENGLISH summary Presented at 2nd Conf. on Axiomatical Field Theory and Theory of Elementary Particles, Kiev, Apr. 1968
(ITF-68-29; CONF-680453-19) Avail: AEC Depository Libraries

Finite-frequency canonical (generally, nonlinear) transformations and single-parameter groups of similar transformations are considered. A necessary and sufficient condition is found that the above transformations be generated by a unitary operator, i.e., the criterion is given for transformations to be proper ones. It is proved that for any canonical transformation (and even for a single-parameter group of similar transformations) there exists the representation of the operators transformed in which it is proper. Author (NSA)

N69-29420# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
CONSTRUCTION OF FIELD THEORY MODEL ON THE BASE OF UNITARITY CONDITION
B. V. Medvedev, M. K. Polivanov, and A. D. Sukhanov 1968 23 p refs In RUSSIAN; ENGLISH summary Presented at 2nd Conf. on Axiomatical Field Theory and Theory of Elementary Particles, Kiev, Apr. 1968
(ITF-68-43; CONF-680453-18) Avail: AEC Depository Libraries

A solvable model of field theory is formulated. A set of model equations is derived from the spectral representations which account only for the contribution of a single-particle state. The general solution of the model admits two possibilities. One of them which has been considered earlier corresponds to a simple Lagrangian formulation but complicated constructions of formulas in the S-matrix theory. The other possibility is associated with simple relations of the S-matrix theory but a complicated Lagrangian formulation. In conclusion, the second-order operators and the products of Heisenberg fields in the model are considered. Author (NSA)

N69-29434# Princeton Univ., N.J. Palmer Physical Lab.
PROTON DECAY OF ISOBARIC ANALOGUE STATES FROM THE (p,n) REACTION IN NUCLEI WITH A FROM 87 TO 128
Peter S. Miller Aug. 1968 151 p refs
(Contract AT(30-1)-937)
(PUC-937-339) Avail: CFSTI

Isobaric analog states of ground states were studied by the (p,n) charge-exchange reaction, using isotopically enriched targets of the above nuclides. The proton decay (p) of the analog state was observed using solid-state detectors in a particle identifier configuration. Absolute cross sections for the (p,np) reaction are presented. An estimate of the amplitudes for mixing between the analog configuration and nearby levels having different isotopic spin shows that gamma-decay of the analog may compete significantly and observably with the proton decay mode in some cases where neutron decay is impossible. For certain targets (^{91}Zr, ^{95}Mo, ^{115}Sn) whose analog states have no neutron decays, the (p,n) cross sections were calculated in the distorted-wave Born approximation, using a consistent, charge-independent formalism. The results were compared with the measured (p,np) cross sections. Author (NSA)

N69-29438# California Univ., Livermore. Lawrence Radiation Lab.
COLLECTIVE ION ACCELERATION AT VERY HIGH ENERGY IN A STATIC MAGNETIC FIELD
Nicholas C. Christofilos 18 Sep. 1968 4 p refs Presented at the IEEE 1969 Particle Accelerator Conf., Washington, 5–7 Mar. 1969 Submitted for publication Sponsored by AEC
(UCRL-71415; CONF-690308-3) Avail: CFSTI

A method for accelerating ions is described in which extremely relativistic electrons are injected in a static magnetic field and form a ring which subsequently is compressed by a sequence of axial accelerations and decelerations. Ions trapped in the electrostatic field of the electron ring can in principle be accelerated in a decreasing magnetic field to very high energy (γ_f) where ($\gamma_i < \gamma_e$ and γ_i, γ_e are the final ion and electron energy, respectively, expressed in rest mass units. The electrons in the ring are confined by an external magnetic field. Radial stability of the trapped ions is provided by imposing on them an azimuthal momentum equal and opposite to the electron azimuthal momentum so that both ions and electrons are magnetically focused by the external magnetic field. The ions are initially accelerated by adiabatic expansion of the ring in a decreasing magnetic field; subsequently the ring is decelerated at constant radius. During this step the ions acquire an azimuthal mechanical momentum almost equal to that of the relativistic electrons. Author (NSA)

N69-29439# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Inst. Teoreticheskoi i Eksperimental'noi Fiziki.
EXPERIMENTAL INVESTIGATION OF THE DYNAMICS OF PROTONS IN A TIGHTLY-FOCUSED LINEAR ACCELERATOR. [EKSPERIMENTAL'NOE IZUCHENIE DINAMIKI PROTONOV V ZHESTKOFOKUSIRUYUSHCHEM LINEINOM USKORITELE]
V. A. Batalin, I. M. Kapchinskii, and V. K. Plotnikov 1968 26 p refs In RUSSIAN; ENGLISH summary
(ITEF-617) Avail: AEC Depository Libraries

The data on the momentum spread of particles for large and small beam currents in different operation conditions of the linac injector of the ITEP proton synchrotron are given. The method of measurement and evaluation of spectra are described. The experimental data are compared with theoretical estimates. The question on the dependence of the beam energy spectrum on the accelerating conditions is discussed. The transverse phase space of the beam is estimated. Author (NSA)

N69-29440# Institute of Nuclear Research, Krakow (Poland).
GLORY EFFECT IN THE OPTICAL MODEL ANALYSIS OF THE K-39 (ALPHA,ALPHA) K-39 ELASTIC SCATTERING
A. Budzanowski, A. Dudek, R. Dymarz, K. Grotowski, L. Jarczyk et al Jul. 1968 23 p refs
(INP-614) Avail: AEC Depository Libraries

An optical model analysis of the $^{39}K(\alpha,\alpha)^{39}K$ scattering data in the wide angular range up to 179° and for nine different energies of alpha particles from 22.1 to 28.2 MeV was done in order to investigate whether the so called nuclear glory effect is contained in the optical model. Six 4-parameter potentials describing elastic scattering were found with the depth of the real part ranging from 100 MeV to 300 MeV. Only the potentials with the real part deeper than 200 MeV can reproduce the backward scattering. The radius parameters corresponding to these deep potentials are rather small ($r_0 \sim 1.1$ fm). It was shown in an additional study that partial waves corresponding to the surface region of the target nucleus play an essential role for the backward scattering. Author (NSA)

N69-29442# Sandia Labs., Albuquerque, N. Mex.
A TABULATION OF FISSION NUCLIDES VS SELECTED TIME PERIODS AFTER FISSION; LISTED IN ORDER OF DECREASING GAMMA RAY ENERGY INTENSITY
John L. Lemmons and Paul O. Matthews Dec. 1968 143 p
(SC-M-68-827) Avail: CFSTI

Fission product nuclides are tabulated for selected time periods after fission. For each time period the nuclides present are listed in order of decreasing gamma-ray energy intensity. Author (NSA)

N69-29455# Texas Univ., Austin. Center for Nuclear Studies.
RESEARCH IN NUCLEAR PHYSICS Progress Report
Dec. 1968 54 p refs
(Contract AT(40-1)2972)
(ORO-2972-80; PR-7) Avail: CFSTI

An intensive study of isobaric analog resonances in various isotopes of Kr, Te, Xe, Cd, Ag, Zr, Mo, and Sc has produced a wealth of information with respect to level structure, spins, parities, and spectroscopic factors of the states observed. Studies of direct interaction and fluctuations in the reaction $^{31}P(d,\alpha)^{29}Si$ were performed and were compared to the predictions of the Ericson fluctuation theory. Direct reaction investigations in isotopes of Be, B, C, N, P, Cr, Zr, Mo, Y and Xe yielded substantial results on charge exchange threshold effects, direct nucleon pickup, spectroscopic factors, and nuclear structure. New theoretical approaches to provide a more detailed description of isobaric analog resonances were developed. Twenty-one computer programs were developed for the analysis of data and the theoretical prediction of nuclear structure and spectroscopic factors. Instrumentation as well as new research facilities and techniques was developed. Author (NSA)

N69-29456# Texas Univ., Austin. Center for Nuclear Studies.
TWO-NUCLEON TRANSFER IN (d, ALPHA) REACTIONS
J. R. Curry, P. J. Riley, and W. R. Coker Nov. 1968 171 p refs
(Contract AT(40-1)-2972)
(ORO-2972-88; TR-6) Avail: CFSTI

Angular distributions for the (d,α) reactions on ^{13}C, ^{14}N, and ^{31}P were measured in the 10 to 12 MeV incident deuteron energy range. Differential cross sections for the $^{31}P(d,\alpha)^{29}Si$ and $^{12}C(d,\alpha)^{10}B$ reactions were also measured between 13° and 60° at an incident deuteron energy of 33.7 MeV. The experimental angular distributions were fitted and analyzed using a zero-range DWBA two-particle pick-up calculation. In addition, the ground-state reactions were analyzed with a cluster-transfer approximation. These analyses allowed determination of the dominant LJ values contributing to the various (d,α) reactions studied. Further, nuclear structure factors were computed from shell-model wave functions and tested against the experimental results. Author (NSA)

N69-29457# Princeton Univ., N.J. Palmer Physical Lab.
TWO-PARTICLE TRANSFER IN DEFORMED NUCLEI
George F. Bertsch Nov. 1968 13 p refs Supported in part by AEC, and the Higgins Sci. Trust Fund
(PUC-937-341) Avail: CFSTI

Correlations between Nilsson orbitals in deformed nuclei might profitably be studied by two-nucleon transfer reactions. Variations in transfer strength by factors of ~ 30 were obtained in a crude calculation for strengths to different states in typical reactions. It turns out that the momentum correlation between the particles transferred is much more important than special correlation of the orbitals in producing large transfer strengths. Author (NSA)

N69-29461# Rensselaer Polytechnic Inst., Troy, N.Y. Dept. of Chemistry.
DECAY PROPERTIES OF NEUTRON EXCESS ISOTOPES Technical Progress Report, 1 Apr. 1967--31 Dec. 1968
I. L. Preiss and H. M. Clark Jan. 1969 8 p
(Contract AT(30-1)-3948)
(RPI-3948-1) Avail: CFSTI

The half-lives and γ energies of ^{40}Cl, ^{42}K, ^{43}K, ^{46}Sc, ^{47}Sc, ^{48}Sc, and ^{48}V formed in photonuclear reactions on ^{51}V were measured, together with integrated cross sections for the various photonuclear processes. The decay scheme of ^{58}Ni from the reaction $^{58}Ni(\gamma,2n)^{56}Ni$ was investigated; evidence for two closely spaced levels at about 1.0 MeV in ^{56}Co was obtained. Photonuclear reactions on Gd were investigated by irradiating samples of Gd_2O_3 at electron beam energies up to 50 MeV. The decay schemes of ^{124}Ba-^{124}Cs were investigated. NSA

N69-29462# Australian National Univ., Canberra. Dept. of Nuclear Physics.
OPTICAL MODEL ANALYSIS OF 29-MeV He SUP 3 DIFFERENTIAL CROSS SECTION AND TOTAL REACTION CROSS SECTION DATA
D. J. Baugh 1969 37 p refs
(ANU-P/427) Avail: AEC Depository Libraries

Differential cross sections and total reaction cross section measurements for ^3He ions scattered by Mg, Al, ^{56}Fe, ^{63}Cu, and Ag targets were analyzed using the optical model. Discrete and continuous ambiguities are discussed. The inclusion of reaction cross section measurements did not significantly resolve these ambiguities. Author (NSA)

N69-29465 Vanderbilt Univ., Nashville, Tenn.
MOLECULAR CALCULATIONS. PART 1: MANY-TERM VALENCE-BOND WAVE FUNCTIONS FOR THE HYDROGEN MOLECULE. PART 2: SEMI-EMPIRICAL STUDIES OF THE INDUCTIVE EFFECT
Iran Laurence Thomas (Ph.D. Thesis) 1968 368 p
Avail: Univ. Microfilms: HC $10.65/Microfilm $4.70 Order No. 68-17959

Two research projects involving molecular calculations are discussed. In a valence bond study of the hydrogen molecule, the problem is defined, and the various types of wave functions used to characterize the ground state of the molecule are described. A detailed derivation of the evaluation of the integrals which arise in a diatomic molecular calculation, and the wave function and the construction of the elements of the secular determinant are also treated. Results of the valence-bond wave functions which used imaginary Slater type orbitals (STO's), with principal quantum numbers n up to and including n = 6, are included. The results show that for optimized orbital exponents, a change in the principal

quantum number of an STO of a given type, such as an np orbital, yields a very small change in that STO. It was found that wave functions using STO's with Slater exponents gave poor results, because such exponents are much too diffuse. The second study consisted of several attempts at finding a successful model of the inductive effect in the Hückel and extended Hückel molecular orbital theories. Dissert. Abstr.

N69-29480# Institute of Nuclear Research, Warsaw (Poland).
INTERNAL BREMSSTRAHLUNG IN ELECTRON CAPTURE
Jan Zylicz 1968 22 p refs Presented at the Intern. Conf. on Electron Capture and Higher Order Processes in Nucl. Decay, Debrecen, Hungary, 15–18 Jul. 1968
(INR-P-950) Conf-680703-5) Avail: AEC Depository Libraries

The results of experimental and theoretical studies on the internal bremsstrahlung in electron capture are surveyed with emphasis put on the energy spectra in the case of forbidden transitions. Author (NSA)

N69-29481# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
SOME PROPERTIES OF NONAXIAL ODD NUCLEI
I. E. Kashuba and V. I. Ovcharenko 1968 31 p refs In RUSSIAN; ENGLISH summary
(ITF-68-58) Avail: AEC Depository Libraries

In the framework of the model of nonaxial odd nuclei developed earlier by Davydov, Pashkevich, and Sardarian, sum rules for energy levels, for average values of electric quadrupole and magnetic dipole moments, and for reduced probabilities of E2 and M1 transitions are obtained in the adiabatic approximation in β and γ oscillations. Numerical calculations are carried out of some reduced probabilities of E2 and M1 transitions and of average values of electric quadrupole and magnetic dipole moments; and the values obtained are compared with experimental data for the nuclei ^{165}Ho, ^{167}Er, ^{175}Lu, ^{177}Lu, ^{177}Hf, and ^{181}Ta. Author (NSA)

N69-29483# Israel Atomic Energy Commission, Tel Aviv.
POLARIZATION MEASUREMENTS OF RESONANTLY SCATTERED CAPTURED GAMMA RAYS
R. Moreh, M. Amit, and J. Rajewski Aug. 1968 24 p refs
(IA-1180) Avail: AEC Depository Libraries

The parities of levels excited by resonance scattering of γ rays from neutron capture in iron were measured with a Compton polarimeter. The spins and parities of resonance levels in four isotopes were thus found to be ^{208}Pb (7.279 MeV, 1$^-$), ^{112}Cd (7.632 MeV, 1$^+$), ^{141}Pr (7.632 MeV, 5/2$^-$), and ^{62}Ni (7.646 MeV, 1$^+$), which correspond to E1, M1, E1, and M1 radiation, respectively. The results are discussed in the light of Axel's suggestion regarding the association of these resonances with the tail of the electric giant dipole resonance. Author (NSA)

N69-29499# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.
EFFECT OF CORE PARTICLE-HOLE EXCITATIONS ON PROPERTIES OF VIBRATIONAL STATES
Vincent Gillet, Bertrand Giraud, and Mannque Rho [1968] 8 p refs
(NP-17769) Avail: AEC Depository Libraries

Calculations were performed for the energy levels and transition probabilities for single closed-shell nuclei using 2-quasiparticle configurations mixed with 1p–1h core configurations. Input data were extruded from neighboring odd-A nuclei in order to keep the number of adjustable parameters low. Good agreement was obtained for the odd-parity states, but the even-parity states appear to be of a more complicated nature than is suggested by 2-quasiparticle plus core p–h configurations. NSA

N69-29500# North Carolina State Univ., Raleigh.
[RESEARCH ON NUCLEAR PHYSICS] Progress Report
L. W. Seagondollar [1968] 73 p refs
(Contract AT(40-1)-3624)
(ORO-3624-7) Avail: CFSTI

Investigations of neutron reactions and scattering, neutron resonance parameters, charged-particle reactions and scattering, analog resonances, direct reactions, optical-model analysis, nuclear energy levels, and nuclear decay are summarized. Developments in semiconductor detectors and spectrometers and in accelerator facilities are also outlined. NSA

N69-29502# Geneva Univ. (Switzerland).
INTRODUCTION TO THE PHYSICS OF THE ELEMENTARY PARTICLES. 1: KINEMATICS [INTRODUCTION A LA PHYSIQUE DES PARTICULES ELEMENTAIRES I CINEMATIQUE]
H. J. Gerber 1968 118 p refs In FRENCH
(NP-17766-Pt-1) Avail: AEC Depository Libraries

An introductory course in elementary particle physics is presented. The special relativity theory is considered as a tool and not as a subject of study. Some effects coming from the relativistic transformation laws are considered as, for example, the expansion of time or effects resulting from the relativistic formulation of the conservation of energy and momentum. Only the results that can be derived in a classical fashion are considered. Emphasis is placed on the application of typical examples in the study of the kinematics of elementary particles, rather than a complete formulation of kinematic relations. Author (NSA)

N69-29504 European Organization for Nuclear Research, Geneva (Switzerland).
TOPICAL CONFERENCE ON WEAK INTERACTIONS
27 Mar. 1969 510 p refs Proc. of Conf. held in Geneva, 14–17 Jan. 1969 Sponsored by the Intern. Union of Pure and Appl. Phys.
(CERN-69-7) Copyright. Avail: Issuing Activity

Various aspects of weak interactions are discussed, with attention focused on neutrinos, hyperon and kaon decay, vector currents, and field theories. For individual titles, see N69-29505 through N69-29536.

N69-29505 Oxford Univ. (England).
ACCELERATOR NEUTRINO EXPERIMENTS
D. H. Perkins *In* CERN Topical Conf. on Weak Interactions 27 Mar. 1969 p 1–42 refs (See N69-29504 16-24)
Copyright. Avail: Issuing Activity

The properties of the purely leptonic weak currents, as measured with neutrino beams, are considered. Included in the discussion are lepton conservation, W-boson production, diagonal interactions, neutral currents, and other processes. Some of the semileptonic interactions, involving the weak hadron currents, are also examined, including elastic events, weak pion production, Adler tests of PCAC, highly inelastic reactions, and total neutrino cross sections. Future neutrino event rates are forecast as a function of time for various accelerators and detectors. P.A.B.

N69-29506 Turin Univ. (Italy). Inst. of Nuclear Physics.
SINGLE PION PRODUCTION BY HIGH ENERGY NEUTRINOS
C. Franzinetti *In* CERN Topical Conf. on Weak Interactions 27 Mar. 1969 p 43–59 refs (See N69-29504 16-24)
Copyright. Avail: Issuing Activity

Some of the results obtained from the exposure of the heavy liquid bubble chamber to the neutrino beam are presented. The details of the experimental apparatus are given, and the exposure and analysis of the events explained. Theoretical calculations concerning single pion production by neutrinos are discussed, and the experimental results compared with the theory. An estimate of the axial form factor is included. P.A.B.

N69-29507 Bern Univ. (Switzerland). Inst. of Physics.
DEPENDENCE OF ν-NUCLEUS CROSS SECTIONS ON THE MASS NUMBER
K. Borer, B. Hahn, H. Hofer, F. Krienen, and P.-G. Seiler *In its* Topical Conf. on Weak Interactions 27 Mar. 1969 p 51–71 refs Supported in part by Schweiz. Nationalfonds zur Foerder. der Wiss. Forsch. (See N69-29504 16-24)
Copyright. Avail: Issuing Activity

Some of the results of a neutrino beam experiment, using a multisandwich-like arrangement of Pb, Fe, Al, and C targets and spark chambers, are presented. The muon angle and the muon momentum or minimum momentum were measured, allowing an estimation of the average small four momentum transfer (q^2) for certain classes of events. The experimental arrangement and running conditions are explained; the run was done in parallel with a propane bubble chamber exposure. Possible error sources, which were either estimated or determined experimentally, are discussed, and experimental cross section ratios are given. It was found that for neutrino events with a muon momentum greater than 1.0 GeV/c and the average q^2 approximately 0.3 $(GeV/c)^2$, no suppression effect is observed, in accordance with theory. In the small muon angle (less than 5°) sample containing approximately 200 events and an average q^2 less than or equal to 0.1 $(GeV/c)^2$, within the relatively large statistical error, no deviation from A-proportionality was seen. P.A.B.

N69-29508 Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).
DIFFRACTION MODEL OF HIGH ENERGY NEUTRINO INTERACTIONS
C. A. Piketty and L. Stodolsky *In* CERN Topical Conf. on Weak Interactions 27 Mar. 1969 p 75–89 refs (See N69-29504 16-24)
Copyright. Avail: Issuing Activity

A model to be used for high energy electroproduction or neutrino production, when the electron or neutrino produces an hadronic system of high mass, is discussed. Vector current ideas are generalized to the axial weak current, using the A_1 meson as a chiral partner of the photon. The application of the model involves two fundamental assumptions: (1) meson dominance of the currents in an assumed manner, and (2) the use of physical estimates from real photon, A_1, and pion scattering in the unphysical region of q^2 (momentum transfer) greater than 0. The range of validity of the model is restricted to high energy for the incoming meson; experiments were restricted to the region where the $(mass)^2$ of the system is greater than 3 GeV^2. The general characteristics of the model are discussed; the action of the vector current alone and the treatment of the axial current, as it differs from that of the vector, are considered. Calculated results are given in graphical form for the q^2 distribution for photon, A_1, and pion production. The asymptotic behavior of the total cross sections is also discussed. P.A.B.

N69-29509 Stockholm Univ. (Sweden).
REDUCED EXPERIMENTAL UPPER LIMIT OF THE ELECTRON-NEUTRINO RESTMASS
Karl-Erik Bergkvist (Res. Inst. for Phys., Stockholm) *In* CERN Topical Conf. on Weak Interactions 27 Mar. 1969 p 91–100 refs (See N69-29504 16-24)
Copyright. Avail: Issuing Activity

After a discussion of the main experimental problems to be overcome in attempts to investigate the electron–neutrino mass, an experiment is described which utilized an electrostatic-magnetic spectrometer for studying the tritium beta spectrum around its upper endpoint. The source arrangement is described, and the method for producing the tritium source, using a ion pumping procedure, is discussed. The electrostatic defect corrector at its position intermediately between the source and the detector in the spectrometer is shown photographically. A Kurie plot typical for the kind of data obtained is supplied, with the calculated expected behavior indicated. It is concluded that a finite electron–neutrino restmass larger than 80 eV appears unlikely. Arguments that the relevant part of the tritium spectrum is not unduly distorted by source thickness are presented in support of the results. P.A.B.

N69-29512 Heidelberg Univ. (West Germany). Inst. for High Energy Physics.
HYPERON DECAYS
H. Filthuth *In* CERN Topical Conf. on Weak Interactions 27 Mar. 1969 p 131–182 refs (See N69-29504 16-24)
Copyright. Avail: Issuing Activity

Hyperon decays are discussed with relation to weak interactions, with the emphasis being on leptonic decays. The present theoretical picture is sketched schematically, and it is noted that the experimental data available are in good agreement with theory. Experimental verification of the basic selection rules is discussed, including the search for Σ^+ leptonic decays. Studies on neutral currents present in hyperon decays are considered. Progress in investigations of leptonic decays is surveyed in detail, with current data agreeing quite well with the predictions of Cabibbo's model. Nonleptonic hyperon decays are also examined, including hadronic decays and radiative decays. P.A.B.

N69-29513 Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France). Faculte des Sciences.
THEORY OF NONLEPTONIC HYPERON DECAYS A Survey
Benjamin W. Lee (State Univ. of N.Y., Stony Brook) *In* CERN Topical Conf. on Weak Interactions 27 Mar. 1969 p 183–186 refs Prepared jointly with Inst. des Hautes Etudes Sci., Paris (See N69-29504 16-24)
Copyright. Avail: Issuing Activity

The current algebra treatment of the nonleptonic hyperon decays is reviewed, with a picture emerging in which the parity conserving decays are mediated by baryon pole terms and the parity violating decays by non-pole terms. The strengths of the two processes are related to each other by a given equation. The evaluation of the magnitude of the weak amplitude from the structure of the nonleptonic weak Hamiltonian is discussed. It is stated that a given model is perhaps useful only as a phenomenological representation for a limited range of questions; taking the structure of the equation seriously, however, the conditions under which the divergences are absent within present available techniques are investigated. It is assumed that certain high energy cut-off should be used in the interaction Hamiltonian, and the precise value of the cut-off is discussed. The current algebra analysis is then compared with that of chiral dynamics. Agreement between theory and experiment is considered. P.A.B.

N69-29514 Oesterreichische Akademie der Wissenschaften, Vienna. Institut fuer Hochenergiephysik.
NONLEPTONIC p-WAVE HYPERON DECAYS IN THE QUARK MODEL
D. Flamm and W. Majerotto *In* CERN Topical Conf. on Weak Interactions 27 Mar. 1969 p 197–204 refs (See N69-29504 16-24)
Copyright. Avail: Issuing Activity

It is shown that the nonrelativistic quark model including vector meson exchange processes can explain the phases of all p-wave amplitudes. If a dynamical breaking of SU(3) symmetry is included by using the physical values for the energy of the outgoing pion, the model fits all amplitudes well with only two parameters. One of them is the overall normalization constant; the other one can be understood by the quark wave function normalization volume. Author

N69-29515 Paris Univ., Orsay (France). Laboratoire de l'Accelerateur Lineaire.
NONLEPTONIC K DECAY
B. Aubert *In* CERN Topical Conf. on Weak Interactions 27 Mar. 1969 p 205–223 refs (See N69-29504 16-24)
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Relative decays are discussed, including the methods for determining the type of interaction present in the decay modes. Two pion decay is examined; an experiment is described in which the conclusion was drawn that the violation of the $|\Delta I| = 1/2$ selection rule in K_S decay is of the same magnitude as that in K^+ decay. Three pion decay is discussed with reference to decay rates, Dalitz plot analysis, and the $|\Delta I| = 1/2$ selection rule and phase-space corrections. The use of current algebra in predicting the rates and slopes is evaluated. It is concluded that a better understanding of the theoretical aspects of phase-space calculations in three pion decay is needed, and that more experimental data on the slopes are required in order to test the selection rule independently of this complication. P.A.B.

N69-29516 Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France). Faculte des Sciences.
THE $\Delta I = 1/2$ RULE IN THE $K \rightarrow 3\pi$ DECAY RATES
C. Bouchiat and M. Veltman (Inst. voor Theor. Fys., Utrecht, Neth.) *In* CERN Topical Conf. on Weak Interactions 27 Mar. 1969 p 225–226 refs (See N69-29504 16-24)
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With reference to the varification of the $\Delta I = 1/2$ selection rule by comparing the various 3 pion decay rates, it is stated that the predictions of the rule are ambiguous up to about 10 percent, due to the electromagnetic mass shifts and the occurrence of big slopes. The reason for this is considered. Experimental indications of a linear dependence on the neutral pion energy with a rather large slope are discussed, and the possibility of a certain amount of $\Delta I = 3/2$ admixture is suggested. P.A.B.

N69-29517 European Organization for Nuclear Research, Geneva (Switzerland).
LEPTONIC K DECAYS
Carlo Rubbia *In its* Topical Conf. on Weak Interactions 27 Mar. 1969 p 227–256 refs (See N69-29504 16-24)
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Some of the problems related to leptonic decays of charged and neutral K-mesons are considered. The discussion is divided into five parts: (1) the K_{e2} decay; (2) the K_{e3} decays, and the determination of the Cabibbo angle; (3) the problem of the K_{e3} form factors; (4) the $\Delta I = 1/2$ rule for leptonic decays; and (5) tests of the selection rule $\Delta Q/\Delta S$ for K_{e3} and K_{e4} decays. Author

N69-29518 Pennsylvania Univ., Philadelphia.
PROPERTIES OF K_{13} DECAYS IN THE PION NEUTRINO CENTER OF MASS SYSTEM. A NEW EXPERIMENTAL METHOD OF DETERMINING ϵ AND ITS ENERGY DEPENDENCE
S. L. Marateck and S. P. Rosen *In* CERN Topical Conf. on Weak Interactions 27 Mar. 1969 p 257–261 ref Supported in part by AEC and NSF Prepared jointly with Purdue Univ. (See N69-29504 16-24)
Copyright. Avail: Issuing Activity

It is pointed out that in K_{13} decays, the spectrum for the cosine of β, the angle between the lepton and neutrino in the pion–neutrino center of mass system, is linear for the vector and scalar interactions and the scalar–vector interefernce term. Cos β and V^2 were chosen as the two variables describing the decay, with V^2 representing the invariant mass of the pion and neutrino. Figures are presented which plot the contours of constant cos β and V^2 for K_{e3} and $K_{\mu3}$ decays, and the applications of the linearity are discussed. P.A.B.

N69-29519 Harvard Univ., Cambridge, Mass. Dept. of Physics.
REVIEW OF K_{l3} THEORY
C. Callan *In* CERN Topical Conf. on Weak Interactions 27 Mar. 1969 p 263–270 refs (See N69-29504 16-24)
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The various theoretical strategems utilized for determining the form factors of K_{l3} decays are reviewed, including the use of the Cabibbo theory of semileptonic interactions and a low energy theorem following from the algebra of currents, written in terms of physical form factors. Four ways of going beyond the latter basic calculation are listed and discussed: (1) dispersion relations, using the low energy theorem to eliminate subtraction constants; (2) broken chiral symmetry, plus assumptions about smooth variation of amplitudes; (3) saturation of commutators with few particle states; and (4) phenomenological Lagrangians. P.A.B.

N69-29520 Heidelberg Univ. (West Germany). Inst. for Theoretical Physics.
CORRECTIONS TO THE LOW ENERGY RESULTS OF THE ALGEBRA OF CHARGES
Berthold Stech *In* CERN Topical Conf. on Weak Interactions 27 Mar. 1969 p 271–277 refs (See N69-29504 16-24)
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With the validity of Gell–Mann's algebra of vector and axial vector charges assumed, approaches to adding corrections to low energy results are discussed. The formal part of the results are presented in the form of three statements: (1) Low energy theorems are sum rules obtained from commutators taken between states of finite (or zero) space momentum in the limiting case of vanishing current divergencies and vanishing meson masses. (2) The corrections to the low energy results are due to two related effects: the nonvanishing of the current divergencies, and the non-zero meson mass. The latter leads to an additional term. (3) The result as directly obtained from the commutator can also be read as a twice subtracted dispersion relation; the dispersion integral is identical to the correction integral. These statements are illustrated in a consideration of the K_{l3} form factor describing the spin zero part of the vector current matrix element. Description of the S-wave hyperon decay by the equal time commutator and the case of the nucleon matrix element of the commutation relation for the axial charges, for finite nucleon moments, are also discussed. P.A.B.

N69-29521 European Organization for Nuclear Research, Geneva (Switzerland).
APPLICATION OF VENEZIANO MODEL TO K_{l4} DECAY
R. G. Roberts and F. Wagner *In its* Topical Conf. on Weak Interactions 27 Mar. 1969 p 281–290 refs (See N69-29504 16-24)
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From the Veneziano model together with the soft pion theorems, a hadron current model is constructed. The effect of the Veneziano model is seen in a determination of the phases of the form factors, possible enhancements in the form factors, and prediction of the momentum dependence of K_{l3} form factors. Apart from overall normalization, one free parameter is determined. By fixing this, good agreement with the data can be obtained. Author

N69-29522 European Organization for Nuclear Research, Geneva (Switzerland).
REVIEW OF THE EXPERIMENTAL SITUATION RELEVANT TO CP VIOLATION
J. Steinberger *In its* Topical Conf. on Weak Interactions 27 Mar. 1969 p 291–305 refs (See N69-29504 16-24)
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Experimental results relevant to CP violating effects and their relationship to theories of elementary particle interactions are

reviewed. The CPT conservation and C or T violation in strong or electromagnetic interactions are considered, along with CPT and T invariance in weak interactions and CP violation in K decay. It is concluded that CPT is conserved, and CP and T are violated, although it is not known if this violation is in the strong, electromagnetic, or weak interaction. Some reliable measurements in two pion decay were obtained, and three predictions of the superweak model are in agreement with experiment. P.A.B.

N69-29623 European Organization for Nuclear Research, Geneva (Switzerland).
A MEASUREMENT OF THE PHASE AND THE MODULUS OF η_{00}
J. Chollet (Paris Univ., Orsay, France), J.-M. Gaillard, M. R. Jane (Natl. Inst. for Res. in Nucl. Sci., Chilton, Engl.), T. J. Ratcliffe, J.-P. Repellin et al (Paris Univ., Orsay, France) *In its* Topical Conf. on Weak Interactions 27 Mar. 1969 p 309–327 refs (See N69-29504 16-24)
Copyright. Avail: Issuing Activity

An experiment is described which had as its aim the determination of the phase of η_{00} in order to resolve the ambiguity between the two solutions of the Wu and Yang triangle. The value of $|\eta_{00}|$ was left as a free parameter for the analysis of the data, and both $|\eta_{00}|$ and $|\phi_{00}|$ were determined. The experimental setup is discussed, and the film scanning and measurement criteria are explained. Two types of analysis of the data are presented, made on the assumption that the four gamma rays observed originate from the decay of two neutral pions. These methods are discussed with reference to two pion decay intensity after a regenerator, analysis with the six regenerator positions, and time dependence of $K_S - K_L$ in the 2 pion channel. The values $\phi_{00} = 23^\circ \pm 30^\circ$ and $|\eta_{00}| = (3.2 \pm 0.7).10^{-3}$ were obtained. P.A.B.

N69-29624 European Organization for Nuclear Research, Geneva (Switzerland).
INTERFERENCE BETWEEN K_L AND K_S AMPLITUDES IN THE $\pi^+\pi^-$ DECAY MODE
M. Bott-Bodenhausen, X. de Bouard, D. G. Cassel, D. Dekkers, R. Felst et al *In its* Topical Conf. on Weak Interactions 27 Mar. 1969 p 329–338 refs (See N69-29504 16-24)
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Results are reported from an experiment in which the decay rate of $K^\circ \rightarrow \pi^+\pi^-$ was measured behind a regenerator. A beam of long-lived kaons passed through carbon, and short-lived kaons were regenerated. The data were analyzed under the hypothesis that the state $|K_L>$ has an amplitude for decay into $\pi^+\pi^-$. Several positions and thicknesses of regenerator were used. The observed decay rates are summarized, and their time dependence is shown. To compare the time dependence of the observed rates with the theoretical expectation, the detection efficiency as a function of proper time was calculated by Monte Carlo methods. P.A.B.

N69-29625 Brookhaven National Lab., Upton, N.Y.
A SEARCH FOR THE DECAY OF NEUTRAL KAON YIELDS POSITIVE PION, NEGATIVE PION AND NEUTRAL PION
D. Berley, P. Yamin, K. Koller (Mass. Univ., Amherst), A. Mann (Mass. Univ., Amherst), G. Meisner et al (Mass. Univ., Amherst) *In* CERN Topical Conf. on Weak Interactions 27 Mar. 1969 p 339–342 refs Supported by AEC Prepared in Cooperation with Mass. Univ., Amherst and Yale Univ. (See N69-29504 16-24)
Copyright. Avail: Issuing Activity

The results are presented of a search for the decay $K^\circ_S \rightarrow \pi^+\pi^-\pi^\circ$. A sample of K^0 were produced in the charge exchange reaction $K^-P \rightarrow N\bar{K}^0$ with 400 MeV/c incident K^- in a hydrogen bubble chamber. The events considered are discussed; 29 events, including two possible leptonic candidates, met the three-pion selection criteria, of which 17 survived less than six K_S lifetimes. Their time distribution is plotted, together with geometric detection efficiency computed from the large sample of two body events. The results of a maximum likelihood calculation are consistent with previous results and do not demand any CP violation. P.A.B.

N69-29626 Joint Inst. for Nuclear Research, Dubna (USSR).
ELECTRIC DIPOLE MOMENT OF SPINOR PARTICLES AND ELECTROMAGNETIC CP VIOLATION
A. T. Filippov, Z. Oziewicz, and A. Pikulski *In* CERN Topical Conf. on Weak Interactions 27 Mar. 1969 p 343–348 refs (See N69-29504 16-24)
Copyright. Avail: Issuing Activity

Estimations of edm (electric dipole moment) of spinor particles are considered, assuming that the electromagnetic CP violation is due to the off-mass-shell corrections to the electromagnetic vertices of the particles. A model of the electromagnetic CP violation is proposed, supposing that every particle is composed of some fundamental spinor particles or fields and supposing that the CP-violating electromagnetic interaction is due only to the primary off-mass-shell CP-violating interactions with these fundamental particles. It is demonstrated that the electromagnetic CP-violation may exist which does not contradict present experimental evidence on edm quite independently of special assumptions on the nonleptonic weak interaction, and which may cause rather large effects in electromagnetic processes where the off-mass-shell effects are essential. P.A.B.

N69-29629 Rochester Univ., N.Y.
STRONG INTERACTION IVB MODELS
R. E. Marshak, R. N. Mohapatra, S. Okubo, and J. Subba Rao *In* CERN Topical Conf. on Weak Interactions 27 Mar. 1969 p 371–389 refs (See N69-29504 16-24)
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Some of the predictions of the strong quadratic and strong cubic IVB (intermediate vector boson) models are discussed. With reference to strong quadratic interactions of W's with normal hadrons, the possibility of too large a cross section being predicted for the direct production of W in high energy neutrino collisions is investigated. Potential difficulties for certain of the higher order weak processes which arise from the strong quadratic IVB model are also considered, including elastic neutrino–nucleon scattering and the decay $K_L^0 \rightarrow \mu\bar{\mu}$. The discrepancy between the muon decay constant and the vector coupling constant in β decay is explained as a renormalization effect. The strong cubic IVB model, in which there is solely a strong interaction among the W's, is also examined, with reference to the production of W's in neutrino–nucleon collisions, elastic neutrino–nucleon scattering, and the decay $K_S^0 \rightarrow \mu\bar{\mu}$. It is noted that the strong cubic model incorporates automatically a theory of CP violation. P.A.B.

N69-29630 Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France). Faculte des Sciences.
MASSIVE YANG–MILLS
M. Veltman (Inst. Voor Theor. Fys., Utrecht, Neth.) *In* CERN Topical Conf. on Weak Interactions 27 Mar. 1969 p 391–393 refs (See N69-29504 16-24)
Copyright. Avail: Issuing Activity

The importance of massive Yang–Mills fields in physics is discussed; it is proposed that the intermediate vector bosons of weak interactions may be of the Yang–Mills type. The state of affairs in perturbation theory of massless Yang–Mills fields is examined, with reference to the rules to be used for computing the S-matrix. For studying the divergencies of the theory by performing the Bell–Treiman transformation, the set of rules for diagrams having no or one closed loop is given. P.A.B.

N69-29531 Joint Inst. for Nuclear Research, Dubna (USSR).
PARTIAL SYMMETRY, EQUIVALENCE THEOREMS AND CALCULATION OF HIGHER ORDERS IN NON-RENORMALIZABLE FIELD THEORIES
A. T. Filippov *In* CERN Topical Conf. on Weak Interactions 27 Mar. 1969 p 395–407 refs (See N69-29504 16-24)
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In order to avoid the cut-off difficulties in the theory of the weak interaction, it is suggested that the usual perturbation theory is inadequate and that a different classification of the field theories, other than into renormalizable (R) and non-renormalizable (N) ones, should be considered. A typical mathematical model of the N-theory is considered, in order to find a criterion for such a classification. It is hypothesized that, in localizable theories, the higher order corrections are small and can be calculated by a modified perturbation theory which takes into account the presence of the logarithmic branch point where the coupling constant equals zero; the usual perturbation expansion with a unitary cut-off gives an incorrect impression of the significance of the higher order corrections. A theorem about localizability of the equations is formulated, and general methods for treatment of N-theories are discussed. Related ideas for partial symmetries and equivalence theorems are presented. In considering a model with partial supersymmetry, the exact equations for the Green's functions for M = 0 are found and solved, and it is shown how these functions can be used as the first approximation for the perturbation theory expansion in powers of M. P.A.B.

N69-29532 New York Univ., N.Y. Dept. of Physics.
RADIATIVE CORRECTIONS TO WEAK PROCESSES
A. Sirlin *In* CERN Topical Conf. on Weak Interactions 27 Mar. 1969 p 409–426 refs (See N69-29504 16-24)
Copyright. Avail: Issuing Activity

Comments are made on the radiative corrections to muon decay and to the electron spectrum in allowed beta decay, and current algebra calculations of the radiative corrections to the vector amplitude in beta decay are discussed. Special models are considered with reference to the possible role of the intermediate boson. Attempts to generalize the current algebra results to the axial vector amplitude and finite momentum transfers are reviewed, including the generalization of the Bjorken expansion and the role of the commutator. Considering an arbitrary process A → B, where A and B are assemblies of hadrons and leptons, some of the basic elements of a theory are discussed in which the c number is such that the commutator does not contribute to the connected amplitude and logarithmic divergences cancel. P.A.B.

N69-29533 European Organization for Nuclear Research, Geneva (Switzerland).
A POSSIBLE WAY TO REMOVE DIVERGENCE DIFFICULTIES IN PHYSICS
T. D. Lee *In its* Topical Conf. on Weak Interactions 27 Mar. 1969 p 427–464 refs (See N69-29504 16-24)
Copyright. Avail: Issuing Activity

Divergence difficulties are discussed with relation to electrodynamics and to the weak interaction theory. An approach to making the radiative correction integral finite for all hadron–leptib states is examined, which assumes that at large q^2 the photon propagator goes to zero faster than q^{-2}. The reason why modifications of the propagators imply the use of an indefinite metric is reviewed, and the question of unitarity is discussed. A theory of electrodynamics which satisfies the minimal requirement that all physical observables should be finite is treated in detail. Modified Feynman rules are considered, and a weak interaction theory free of divergence difficulties is obtained. Some of the experimental consequences of the theory, in addition to having all physical observables finite, are then listed. It is stated that the introduction of a negative metric and the possible existence of complex singularities may provide a way out of the divergence difficulties. P.A.B.

N69-29534 Padua Univ. (Italy). Istituto di Fisica.
CHIRAL SYMMETRY BREAKING, ELECTROMAGNETISM, AND CABIBBO ANGLE
R. Gatto *In* CERN Topical Conf. on Weak Interactions 27 Mar. 1969 p 465–483 refs (See N69-29504 16-24)
Copyright. Avail: Issuing Activity

Work on the problem of divergences in weak interactions is reviewed, including an interpretation of previous results. The predictivity requirement, spontaneously broken $SU_2 \times SU_2$, is considered, and the leading divergences are discussed. The Cabibbo angle is considered to be related to the symmetry breaking; the presentation is made in the frame of a renormalization procedure with the added predictivity requirement. Second order calculation is considered in terms of current commutations, and leading divergences at higher order in the quark model are discussed. Two theorems on the leading divergences at any order, the self-mass theorem and the vertex theorem, are reported. Together, the two theorems ensure the renormalizability of the theory in terms of two counter terms; the predictivity requirement for self-mass differences can be imposed, specializing the theory to particular choices for its parameters. The two theorems hold in the quark model without further assumptions, but new requirements are needed in a more general picture based on current commutators. Suitable specializations of field algebra are introduced, including compound field algebra and extended compound field algebra. P.A.B.

N69-29535 Istituto Superiore di Sanita, Rome (Italy). Laboratori di Fisica.
ON THE ORIGIN OF THE WEAK INTERACTION ANGLE
L. Maiani *In* CERN Topical Conf. on Weak Interactions 27 Mar. 1969 p 485–494 refs (See N69-29504 16-24)
Copyright. Avail: Issuing Activity

Recent investigations on the weak interaction angle are discussed, with the basic idea being that the relative orientation of the weak interactions and of the SU(3) breaking, that is, the observed value of the angle, arise from a dynamical interplay of weak, electromagnetic, and strong interactions. The theory is summarized; a basic assumption is that the leading divergent weak corrections to hadron processes, when summed up to all orders, can give rise to effects competitive with strong and electromagnetic effects. A self-consistency condition is formulated, insuring that such corrections, as well as the tadpole e.m. corrections, do not cause a change in the breaking term describing the hadron mass splittings. The dependence of the angle upon the scale parameter, related to the strength of the weak corrections, is discussed. P.A.B.

N69-29536 Sussex Univ., Brighton (England).
WEAK INTERACTIONS AND LOW-ENERGY NUCLEAR PHYSICS
R. J. Blin-Stoyle *In* CERN Topical Conf. on Weak Interactions 27 Mar. 1969 p 495–528 refs (See N69-29504 16-24)
Copyright. Avail: Issuing Activity

Recent theoretical and experimental work contributing to the knowledge of the weak interaction Hamiltonian H_W is discussed. Results from beta decay data are summarized; it is noted that the trend is towards lower values of ft than given by previous data on 0°, and it is suggested that the raw ft for $^{28}Al^m$ should be used as a basis for determining G_V and the Cabibbo angle. Nonleptonic weak interactions in the nucleus are also considered, and experimental results on parity-violating transitions are given and compared with theoretical models. The method of calculation of the weak internucleon potential is demonstrated. Possible tests of T violation in nuclear physics are examined, including detailed balance tests, asymmetry-polarization tests, gamma transition tests, and beta decay tests. P.A.B.

N69-29546# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
ENERGY DEPENDENCE OF THE NUCLEAR CROSS SECTIONS FOR NUCLEONS AT ENERGY ABOVE 50 MeV
V. S. Barashenkov, K. K. Gudima, and V. D. Tonev. 1968 32 p refs In RUSSIAN
(JINR-P2-4183) Avail: AEC Depository Libraries

The curves of the energy dependence of the integral cross sections σ_T, σ_{in}, σ_{el} are given for the interactions of protons with Be, C, Al, Ti, Fe, Cu, Cd, Pb, and U nuclei. Author (NSA)

N69-29549# Illinois Univ., Urbana. Dept. of Physics.
PRODUCTION OF THREE CHARGED PIONS IN PI MINUS PROTON INTERACTIONS AT FIVE GeV
Bernard Terreault (Ph.D. Thesis) Feb. 1969 158 p refs
(Contract AT(11-1)-1195)
(COO-1195-157) Avail: CFSTI

The 72" bubble chamber at the Lawrence Radiation Laboratory has been exposed to a beam of 5 BeV/c π^- mesons and 150,000 photographs have been taken. As a part of this experiment, the interactions producing four charged particles in the final states have been measured and the reaction $\pi^- p \rightarrow p\pi^+\pi^-\pi^-$ has been studied, with the emphasis placed on the three pions system. The cross section for this reaction was found to be 1.80 ± 0.45 mb. For the final analysis 6300 events (.286 ± .071 μb/event) were selected. The mass spectra of the different particle combinations have been investigated. The reaction has been found to be characterized by the following features: Strong production of well-known resonances, in particular the ρ^0 (35% of the events), N^{*++}_{1238} (30%) and various N^{*0}s; A broad enhancement in the $\pi^+\pi^-\pi^-$ and in the $\rho^0\pi^-$ mass between 1.0 and 1.4 BeV, associated with momentum transfers to the proton characteristic of diffraction-scattering. Author (NSA)

N69-29550# Arizona Univ., Tucson.
NUCLEAR PHYSICS Progress Report, 1 Jan.–31 Dec. 1968
Douglas J. Donahue, John D. McCullen, and Lawrence C. McIntyre, Jr. Jan. 1969 14 p refs
(Contract AT(11-1)-1468)
(COO-1468-3) Avail: CFSTI

Doppler-shift measurements of the lifetimes of levels in ^{20}F, ^{26}Mg, ^{27}Mg, ^{29}Si, ^{31}Si, and ^{33}S were made; and a target chamber was developed for Doppler-shift measurements. A program for measuring nuclear level spins and multipole mixing ratios in gamma transitions were initiated; a target chamber for measuring particle-gamma angular correlations from nuclear reactions was developed. Development of the polarized ion source for the CN Van de Graeff accelerator continued. Measurements were made on the reactions ^{49}Ti(p,nγ)^{49}V and ^{50}Ti(p,nγ)^{50}V; new gamma transitions were observed. The time resolution of the particle-gamma fast coincidence system was improved from 60 to 20 nanosec FWHM. NSA

N69-29551# Gulf General Atomic, San Diego, Calif.
LATTICE PHYSICS STUDIES Quarterly Progress Report, Period Ending 31 Dec. 1968
G. D. Trimble and J. M. Neill. 17 Jan. 1969 25 p refs
(Contract AT(04-3)-167)
(GA-9198; EURAEC-2089) Avail: CFSTI

Thermal neutron spectrum measurements were performed in the 1.3 inch pitch lattice of Al–Pu fuel elements which has a volume ratio of water of 6.03. These measurements were performed at room temperature using time-of-flight techniques. The fabrication of the experimental tank for studying thermal neutron spectra in plutonium nitrate solutions is described. The on-line checkout testing of the tank and glove box system is described. NSA

N69-29552# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Nuclear Problems.
QUASIELASTIC SCATTERING OF 685 MeV PROTONS ON ALPHA-PARTICLE CLUSTERS IN LIGHT NUCLEI
V. I. Komarov, G. E. Kosarev, and O. V. Savchenko. 1968 10 p refs In RUSSIAN
(JINR-P1-4227) Avail: AEC Depository Libraries

The cross sections for knocking out ^{4}He nuclei with energy about 470 MeV from ^{6}Li, ^{9}Be, ^{12}C targets at 5.4° to a 685-MeV proton beam were measured. ^{4}He nuclei were identified by the effective momentum, time-of-flight, specific energy loss, total energy loss, and range. The comparison of cross sections obtained for quasielastic scattering with the cross section of elastic proton scattering measured in the same conditions gives the effective numbers of alpha clusters in the investigated nuclei. These values are close to those obtained using the shell model for alpha-clustering calculations. The results obtained confirm the correctness of basic ideas on quasielastic knocking out of high-energy ^{4}He by fast protons from light nuclei and, in particular, show the proximity of internal structure of the alpha-cluster and free ^{4}He nuclei at small (about 0.1 fermi^{-1}) relative distances. Author (NSA)

N69-29560# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
CORRELATION AND GREEN'S FUNCTIONS FOR SYSTEMS WITH FOUR FERMION POSITIVE INTERACTION
N. N. Bogolyubov 1968 23 p refs
(ITF-68-67) Avail: AEC Depository Libraries

A method of constructing an asymptotically exact solution for the model of a system with positive pair four-fermion interaction is presented. The problem of constructing asymptotically exact expressions (as $V \rightarrow \infty$) for the correlation and Green's functions of any order is investigated. Author (NSA)

N69-29561# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
FORMATION OF NEUTRAL VECTOR MESONS DURING HADRON INTERACTION
M. P. Rekalo 1968 20 p refs In RUSSIAN Presented at the 2d Conf. on Axiomatical Field Theory and Theory of Elementary Particles, Kiev
(ITF-68-38; CONF-680453-20) Avail: AEC Depository Libraries

The formation of low-energy neutral vector mesons in the reactions $\gamma + N \rightarrow N + V^0$, $\pi + N \rightarrow N + V$, $\bar{p} + p \rightarrow V^0_1 + V^0_2$, $K^- + p \rightarrow Y + V$, $\pi^- + p \rightarrow \pi^- + p + V^0$, $p + p \rightarrow p + p + \omega$ is considered in the quark model. The near-threshold behavior of these processes can be explained in a model based on the quark-nuclear analogy: the emission of γ-quanta by a nuclear system and the emission of neutral vector mesons by a quark system generated due to hadron collisions are considered to be quite similar. In this model the vector mesons of electric monopole type with J = 0 and positive parity should be created near the threshold in an overwhelming way. Then the isotropic angular distribution is predicted for the reaction $K^- + p \rightarrow \gamma + V^0$, $\pi^- + p \rightarrow n + V^0$ the angle dependence of the type $\sin^2\theta$ is predicted for the processes $\gamma + p \rightarrow p + V^0$. Author (NSA)

N69-29585# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
DEPENDENCE OF COUPLING ENERGY OF THREE- AND FOUR-PARTICLE SYSTEMS ON THE PARAMETERS OF PAIR POTENTIAL
V. N. Maksimenko and V. Ye. Antonchenko 1968 23 p refs In RUSSIAN; ENGLISH summary Presented at 2nd Conf. on Axiomatical Field Theory and Theory of Elementary Particles, Kiev, Apr. 1968
(ITF-68-68; CONF-680453-14) Avail: AEC Depository Libraries

A method of determining the parameters depending on the spin of the pair attractive potential, on the basis of experimental

data concerning nucleon scattering is presented. The coupling energy of three- and four-particle systems with pair attractive forces of the type $V_0 ch^{-2} r/r_0$ and $V_0 \exp(-r^2/r^2_0)$ is studied. The Coulomb corrections to the ground-state energy are calculated, and the dependence of coupling energy of the nuclei ^3H, ^3He, ^4He on the parameters of the pair potential is studied. Author (NSA)

N69-29586# Akademiya Nauk URSR, Kiev. Institut Teoreticheskoi Fiziki.
REMARK ON THE η YIELDS 3π DECAY
B. V. Struminskii 1968 7 p refs In RUSSIAN; ENGLISH summary Presented at Conf. on Composite Models of Elementary Particles, Kiev, Jun. 1968
(ITF-68-49; CONF-680647-3) Avail: AEC Depository Libraries

The decay rate $\eta' \rightarrow 3\pi$ is calculated. The calculations are based on the pole model of the $\eta \rightarrow 3\pi$ decay. The matrix element of the $\eta \rightarrow \pi$ transition is calculated using the finite energy sum rules for the virtual compton-scattering amplitude. NSA

N69-29587# Illinois Univ., Urbana. Dept. of Physics.
A SUB 2 MESON PRODUCTION IN NEGATIVE PION PROTON INTERACTIONS AT 5 GeV
Elton Dusne Schafer (Ph.D. Thesis) Jan. 1969 165 p refs
(Contract AT(11-1)-1195
(COO-1195-158) Avail: CFSTI

The meson (A_2) was studied from data obtained from $\pi^- + p$ interactions at 5 GeV/c in the Alvarez liquid hydrogen bubble chamber. The $\rho\pi$ decay mode in the 4-constraint $p\pi^+\pi^-\pi^-$ final state is treated in detail. The spin-parity analysis of the A_2 yields results consistent with a $J^P = 2^+$ assignment. The production of this resonant state appears to be confined essentially to the momentum transfer range $0.125 \leq t \leq 2$ GeV^2. NSA

N69-29574 Tulane Univ., New Orleans, La.
NUCLEAR SPIN-LATTICE RELAXATION IN CALCIUM FLUORIDE: DIVALENT EUROPIUM ION
Carol Leona O'Loughlin (Ph.D. Thesis) 1968 102 p
Avail: Univ. Microfilms: HC $5.20/Microfilm $3.00 Order No. 68-15259

An experimental study of nuclear spin-lattice relaxation was conducted on eight CaF_2 single crystals. The crystals were doped with Eu^{++} in concentrations which were determined to be from 0 to 6 × 10^{19}cm^{-3}. Additional impurity analysis on the undoped crystal showed it to contain about 100 ppm of the paramagnetic impurities Fe^{++}, Ni^{++}, and Cu^{++}. These impurity levels are taken as representative of the other crystals, since all were grown at once from the same raw material. The theory of nuclear spin-lattice relaxation by dilute concentrations of paramagnetic ions is traced from the work of Bloembergen through that of Rorschech, resulting in equations for the nuclear spin-lattice relaxation time, T_1. The basic paramagnetic spin-lattice relaxation processes are discussed briefly, and their field and temperature dependences are given. A general analysis of the data is made which identifies the type of nuclear and ionic relaxation processes dominant in a particular temperature range. Dissert. Abstr.

N69-29575# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
ELECTROPRODUCTION OF PIONS NEAR THE DELTA (1236) ISOBAR AND THE FORM FACTOR OF THE (GAMMA, n, DELTA)-VERTEX
W. Bartel, B. Dudelzak, H. Krehbiel, J. McElroy, U. Meyer-Berkhout et al Oct. 1968 15 p refs Prepared in cooperation with Hamburg Univ.
(DESY-68/53) Avail: AEC Depository Libraries

The cross section for inelastic electron–proton scattering was measured at incident electron energies of 1.5 to 6 GeV by magnetic analysis of the scattered electrons at angles between 10 and 35°. For invariant masses of the hadronic final state $W \leq 1.4$ GeV, the measured spectra are compared with theoretical predictions for electroproduction of the Δ (1236) isobar. The magnetic dipole transition form factor of the $(\gamma N\Delta)$-vertex is derived for momentum transfers $q^2 = 0.2 - 2.34$ $(GeV/c)^2$ and found to decrease more rapidly with q^2 than the proton form factors. Author (NSA)

N69-29581# Catholic Univ. of America, Washington, D.C. Dept. of Space Science and Applied Physics.
RATE COEFFICIENTS RELEVANT TO THE H SUB 2 UV LASER Final Report
A. W. Ali and A. D. Anderson NRL Feb. 1969 21 p refs
(Contract N00014-66-C-0043; ARPA Order 660)
(AD-685193; NRL-6789) Avail: CFSTI CSCL 20/5

Rate coefficients for the electron impact excitations of two electronic states of the H2 molecule-2p piPi sub u and 2p sigma Sigma sub u --have been obtained using calculated cross sections. The ionization rate coefficient and energy loss by electrons to the ground-state vibrational levels of the H2 molecule have been calculated using relevant measured cross sections. In addition the rate of energy loss by electrons into the excitation of 3 Sigma sub u and 3 Sigma sub g levels has been calculated. Author (TAB)

N69-29583# Technische Hochschule Stuttgart (West Germany). Inst. fuer Kernenergetik.
DIRECT DETERMINATION OF TRANSMISSION AND REFLECTION MATRICES FOR GAMMA RAYS [DIREKTE BESTIMMUNG VON TRANSMISSIONS- UND REFLEXIONS-MATRIZEN FUER GAMMASTRAHLEN]
K. H. Hoecker, ed., E. Bagge, ed., and G. Boehnecke, ed. 1968 47 p refs In GERMAN *Its* Preprint No. 11
(NP-17727) Avail: Verlag Karl Thiemig KG, Munich, West Ger.: DM 7.80

The applicability of the invariant embedding method (the matrix method) to the calculation of reactor shielding was studied. The transmission and reflection matrices of plane layers for γ rays were calculated with the MOTRA 1–4 program of the TR4 computer. Comparisons were made with the Double P_3 transport program GAMP 3 of the ER56. The principles of the theory are first given, and the program is described. The numerical results are presented. Author (NSA)

N69-29604# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of High Energy.
INVESTIGATIONS OF THE POSITIVE rho MESON AND BARYON RESONANCE PRODUCTION IN TWO-PRONGED POSITIVE PION PROTON INTERACTIONS AT 2.34 GeV/C
N. Angelov, I. M. Gramenitskii, Kh. Kanazirski, A. M. Moiseev, A. Prokesh et al 1969 27 p refs In RUSSIAN
(JINR-PI-4271) Avail: AEC Depository Libraries

The experimental data on the investigation of the ρ^+-meson and N^{*++} isobar production as well as the differential production cross sections of these resonances, angular distributions of their decay products, and the dependence of the spin matrix density elements on the four-momentum are presented. The comparison with some OPE models is made. Author (NSA)

N69-29606# Atomic Weapons Research Establishment, Aldermaston (England).
THE CROSS SECTION FOR THE OXYGEN 16 (NEUTRON, alpha) CARBON 13 REACTION FOR NEUTRON ENERGIES IN THE RANGE 7–12 MeV
D. Dandy, J. L. Wankling, and C. J. Parnell Oct. 1968 14 p refs
(AWRE-O-60/68) Avail: CFSTI HMSO 2s 6d

The cross sections for the reactions $^{16}O(n,\alpha)^{13}C$ and $^{16}O(n,\alpha_0)^{13}C$ were measured in the neutron energy range from 8 to 12 MeV using monoenergetic neutrons from the tandem Van

de Graaff at AWRE Aldermaston. Absolute determinations of these cross sections were not made, but the results were normalized to existing data in the neutron energy range 7 to 8.7 MeV.
Author (NSA)

N69-29618# Deutsches Elektronen-Synchrotron, Hamburg (West Germany).
REACTIONS (GAMMA,n) IN THE ENERGY RANGE FROM 1.0 TO 5.5 GEV
H. G. de Carvalho, V. di Napoli, D. Margadonna, F. Salvetti, and K. Tesch Nov. 1968 16 p refs
(DESY-68/57) Avail: AEC Depository Libraries

The (γ,n) cross sections per equivalent quantum of ^{12}C, ^{103}Rh, ^{127}I, ^{197}Au, and ^{238}U were measured with a bremsstrahlung beam of maximum energies in the range from 1 up to 5.5 GeV. Within the experimental errors of the activation method, no contribution of photons above 1 GeV was found. This result disagrees with some previous measurements made at energies below 1 GeV but agrees with the predicted values obtained from simple theoretical estimates.
Author (NSA)

N69-29630# Czechoslovak Academy of Sciences, Prague.
THE DIPOLE PHOTODISINTEGRATION OF Be-9
L. Majling, V. I. Kukulin, and Y. F. Smirnov Oct. 1968 26 p refs
(UJV-2092-F) Avail: AEC Depository Libraries

The absorption spectrum for dipole γ quanta with energies below 35 MeV is calculated using the many-particle nuclear shell model. The cross sections of the partial photo-nuclear reactions (γ,n), (γ,p), (γ,d), and (γ,α) and the photonucleon spectra are calculated. Spin-orbit interactions are neglected, and it is assumed that the residual pairing interaction is well described by Serber forces. The supermultiplet structure of the spectrum of excited levels is thus preserved; and the matrix of the Hamiltonian decomposes into a number of submatrices having considerable lower order, each of which can be diagonalized separately. This circumstance makes it possible to consider states that are not directly excited in the γ-quantum absorption, which however do considerably influence the structure of the absorption curve and especially the decay properties of the excited levels and the spectrum of emitted particles. The agreement with the experimental data is very satisfactory.
Author (NSA)

N69-29639# Gosudarstvennyi Komitet po Ispolzovaniyu Atomnoi Energii, Serpukhov (USSR). Institut Fiziki Vysokikh Energii.
SELF-FOCUSING PROTON LINEAR ACCELERATOR
V. A. Teplyakov, A. P. Maltsev, S. M. Ermakov, A. V. Zotov, and V. A. Yurchenko Sep. 1968 10 p refs In RUSSIAN
(IEVE-INZH-68-35-K) Avail: AEC Depository Libraries

The parameters of a self-focusing proton linear accelerator are discussed. The energy of accelerated particles is 50 MeV, and the beam current is 100 mA. The accelerating system is based on an H-cavity, whose diameter is 3 to 5 times smaller than that of an Alvarez cavity of the same wavelength. It is shown that focusing by means of an accelerating field in the structure of double-gap drift tubes can provide the specific acceleration not less than $2.7 \cdot 10^{-3}$ and normalized acceptance of the channel not less than 1 mrad-cm.
Author (NSA)

N69-29656# Oak Ridge National Lab., Tenn.
INTERACTION CROSS SECTIONS OF FAST PARTICLES AND ATOMIC NUCLEI
V. S. Barashenkov et al [1969] 43 p refs Transl. into ENGLISH from Russian Repr. JINR-P2-4068
(ORNL-tr-2073; JINR-P2-4068) Avail: CFSTI

A summary is given of the available experimental data on the total cross sections and the elastic and inelastic cross sections of nucleons, antinucleons, π-mesons, and K-mesons with atomic nuclei in the range of the energies above 50 MeV. The cross sections of the nucleus-nucleus interactions are pointed out (for kinetic energies above 50 MeV/nucleon). The experimental data are discussed.
Author (NSA)

N69-29712# Centralny Instytut Informacji Naukowo-Technicznej i Ekonomicznej, Warsaw (Poland). Scientific Publications Foreign Cooperation Center.
NUKLEONIKA, VOLUME 11, NO. 11/12, 1966
1967 67 p refs Transl. into ENGLISH of Nukleonika (Warsaw), v. 11, no. 11/12, 1966 Published for AEC and NSF
(AEC-tr-6657; AEC-tr-6658) Avail: CFSTI

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4. SOME PROBLEMS CONCERNING THE THEORY OF ERRORS IN COUNTING CIRCUITS (PULSE COUNTERS) T. Rzymkowski et al p 19–27 refs (See N69-29716 16-14)

5. ANGULAR BETA-RAY BACK-SCATTERING R. Szepke p 28–32 refs (See N69-29717 16-24)

6. A SIMPLIFIED MODEL OF BOILING DURING A TWO-PHASE SLUG FLOW IN A VERTICAL TUBE J. Madejski p 33–64 refs (See N69-29718 16-12)

7. TRANSISTOR LINEAR GATE S. Pachela et al p 65–74 refs (See N69-29719 16-09)

N69-29713# Centralny Instytut Informacji Naukowo-Technicznej i Ekonomicznej, Warsaw (Poland). Scientific Publications Foreign Cooperation Center.
DETERMINATION OF RADIAL DISTRIBUTION OF MUONS IN EXTENSIVE AIR SHOWERS AT DISTANCES CLOSE TO THE AXIS
Bazyli Bonczak et al *In its* Nukleonika, vol. 11, no. 11/12, 1966 1967 p 1–7 refs (See N69-29712 16-24)
Avail: CFSTI

The arrangement by which some 3000 showers were recorded is shown; the individual localization of an axis, or determination of the most probable area of the shower axis, was based on the analysis of the number of times charged particles and particles of the penetrating component struck the detectors. The axes of 2489 showers were localized at distances of 4 to 18 m. The method is presented and discussed as to classification by subsets, multiplication effects, and partial distributions. In determining the most probable density in a given section for successive showers, it was assumed that there is no density gradient on the surface of the section and that the muon distribution on the surface is a Poisson distribution. The calculated results are plotted and compared with the Greisen distribution.
P.A.B.

N69-29717# Centralny Instytut Informacji Naukowo-Technicznej i Ekonomicznej, Warsaw (Poland). Scientific Publications Foreign Cooperation Center.
ANGULAR BETA-RAY BACK-SCATTERING
Ryszard Szepke *In its* Nukleonika, vol. 11, no. 11/12, 1966 1967 p 28–32 refs Presented at Inst. of Nucl. Res., Warsaw, 11 Jan. 1966 (See N69-29712 16-24)
Avail: CFSTI

With the use of a back-scattering and detecting device with an end window G-M tube, the angular distribution of back-scattering betas was observed from different materials, such as Plexiglas, aluminum, steel, cadmium, and lead. Data are also presented for the effects of incidence and reflection angles on errors in determining the coating thickness. Although different sources were used in the study, the presented results are for the strontium-90 source only. P.A.B.

N69-29790# Brookhaven National Lab., Upton, N.Y.
REMARKS ON ELECTROMAGNETIC INTERACTIONS OF NEUTRAL KAON SUB L,S MESONS
L. I. Lapidus [1968] 6 p refs Transl. into ENGLISH from Russian Rept. JINR-P2-4047
(BNL-tr-249; JINR-P2-4047) Avail: CFSTI

The $K^0_2 \rightarrow K^0_1$ regeneration on electrons and the possibility of observing various effects associated with the electromagnetic interactions of the K^0_2, K^0_1 mesons are considered. The possibility of observing the effects of electromagnetic regeneration as a result of the study of asymmetry in the leptonic decay behind the plate is discussed. Also discussed is the small effect of the CP violation in the superposition of K^0_2 and K^0_1 on the electromagnetic regeneration of K^0_2, K^0_1 mesons and on the pair production process of $K^0-\bar{K}^0$ in electron-positron collisions. NSA

N69-29791# Osaka Univ. (Japan). Lab. of Nuclear Studies.
EXCITATION FUNCTIONS FOR THE (d,p) REACTIONS ON Ru 96, Ru 102, AND Ru 104
A. Mito, K. Komura, T. Mitsugashira and K. Otozai [1968] 22 p refs
Avail: AEC Depository Libraries

Excitation functions for the (d,p) reactions on ^{96}Ru, ^{102}Ru, and ^{104}Ru were measured with the activation method up to 14.0-MeV deuteron energy. The results were explained with the modified Pesslee theory by using different values of the total absorption parameter. It was found on the even-even target nuclei that the values of ρ for the (d,p) reactions grow large as their isotopic numbers N-Z increases. Author (NSA)

N69-29809*# Lockheed Electronics Co., Houston, Tex.
CONFIGURATION INTERACTION MATRIX ELEMENTS FOR d SUP n CONFIGURATIONS. PART 2
J. A. Barnes, B. L. Carroll, and L. M. Flores May 1969 13 p refs
(Contract NAS9-5384)
(NASA-CR-101704) Avail: CFSTI CSCL 20H

The matrix elements of the configuration interactions between the core excitation $1^{+}4l'+1d^{n+1}$ and the d^n configuration, for $n = 3,4,5$ and $l' = s,d$, are computed and tabulated for general usage. Author

N69-29813# McDonnell-Douglas Astronautics Co., Santa Monica, Calif. Nuclear Technology and Subsystems Branch.
CHARGE CODE FOR SPACE RADIATION SHIELDING ANALYSIS
W. R. Yucker and J. R. Lilley Apr. 1969 214 p refs
(DAC-62231) Avail: Issuing Activity

This report describes CHARGE, a FORTRAN 4 program for the analysis of primary electron and proton or heavy charged particle passage through plane or spherical shields containing up to 100 regions, and the attendant generation and transmission of electron-induced X-rays (bremsstrahlung) and proton-induced secondary protons and neutrons. Proton and electron analyses use a modification of the range-energy relationship applied to as many as 100 energy groups, while the bremsstrahlung transmission calculation assumes an exponential attenuation corrected by semiempirical dose buildup factors applied individually to a similar number of gamma ray energies. Availability of several bremsstrahlung source options permit comparison of most commonly used approximations. Energy dependent removal cross sections are used to calculate secondary neutron transmission. The ambient charged particle spectra may be specified in differential form as varying either as a power of energy or as an exponential of energy or in integral form as exponential in rigidity over each of several specified energy ranges, in tabulated or functional form. The analysis is described, and results are compared to other calculations and to experiments. Author

N69-29837# McDonnell-Douglas Co., Huntington Beach, Calif. Advanced Research Labs.
RADIOACTIVE LIFETIMES IN THE RESONANCE SERIES OF NeI
George M. Lawrence and Harvey S. Liszt (Princeton Univ. Obs.) Nov. 1968 23 p refs *Its* Research Commun. 83
(AD-683561) Avail: Issuing Activity CSCL 7/4

Direct measurements are made of radiative lifetimes of the nine J = 1 levels of the 3s, 4s, 5s, and 3d configurations in Ne I. Branching ratios are calculated in the Coulomb approximation, and oscillator strengths are given for all of the above transitions. The 3s lifetimes agree well with previous experimental results. The cascade lifetimes determined in a two-exponential model are consistent with known lifetimes of visible transitions. Author (TAB)

N69-29867# European Atomic Energy Community, Karlsruhe (West Germany).
THE ISOLATION OF AMERICIUM AND CURIUM FROM IRRADIATED Am SUP 241 TARGETS
W. Muller, F. Maino, and J.-Cl. Toussaint 1969 22 p refs
(EUR-4232.e) Avail: CFSTI

At the European Transuranium Institute irradiated ^{241}Am targets were processed to isolate the heavy nuclides ^{238}Pu, ^{242}Pu, ^{241}Am and ^{242}Cm. The initial α-activity, mainly due to ^{242}Cm, exceeded 3 kCi. The americium-curium fraction was separated from plutonium and fission products by anion exchange from 8 M HCl and 10 M LiCl solution. Americium and curium were precipitated as oxalates, the mixture of the oxalates was transformed into oxides. In order to demonstrate the potential use of ^{242}Cm as a heat source, 4.3 g of the oxide mixture containing approximately 400 mg ^{242}Cm were loaded into a platinum capsule which was sealed by welding. The platinum capsule served to fuel a prototype of a radioisotope power generator. Author

N69-29893# Commissariat à l'Energie Atomique, Fontenay-aux-Roses (France). Centre d'Etudes Nucléaires.
DISLOCATIONS AND RADIATION DAMAGE IN α-URANIUM [DISLOCATIONS ET EFFETS DES RADIATIONS DANS L'URANIUM α]
Jean Loteurtre (Ph.D. Thesis--Paris Univ., 2 Jul. 1968) Mar. 1969 135 p refs In FRENCH; ENGLISH summary
(CEA-R-3607) Avail: CFSTI

Dislocations in α-uranium were studied by electron microscopy; the electropolishing of the thin foils being performed at low temperature (-110°C) to prevent oxidation. Burgers vectors for twin dislocations are defined and interactions between slipping and twinning were studied from both the experimental and theoretical points of view. Samples irradiated at several specific burn-ups were examined. A coherent model is proposed for the fission particle effects in order to explain the micrographic results, and along with all the information gathered in the literature about radiation damage in α-uranium the effects of changes of temperature, dislocation density, impurity content were investigated. The number of point defects created by one initial fission was determined for pure and annealed metal. The importance of self-annealing which occurs immediately in each displacement spike, and the annealing due to a new fission on the damage resulting from a previous fission, are estimated. The focusing distance in the [100] direction is found to be about 1000 Å, at 4°K. Author (ESRO)

N69-29999# International Centre for Theoretical Physics, Trieste (Italy).

MASS SELECTION, BOSE STATISTICS AND KINEMATIC ENHANCEMENT

A. M. Gleeson and W. J. Meggs (Syracuse Univ.) Jul. 1968 22 p refs Sponsored in part by the the AEC Submitted for publication

(IC/68/56) CFSTI: Avail:

In this paper, a simple kinematic mechanism which enhances the three-pion scattering amplitude at the A_1 mass is described. This mechanism is based upon the requirements of Bose symmetry, rho pion scattering dominance and rho mass selection in the final state. The structure of this enhancement is studied and its dependence on the mass selection criteria is shown. Author (ESRO)

N69-30001# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.

STUDY OF TOTAL IONIZATION BY α PARTICLES, IN PURE GASES AND GASEOUS MIXTURES CONTAINING METASTABLE ATOMS, AS A FUNCTION OF TEMPERATURE [ETUDE DE L'IONISATION TOTALE PAR LES PARTICULES α, DANS LES GAZ PURS ET LES MELANGES GAZEUX CONTENANT DES ATOMES METASTABLES, EN FONCTION DE LA TEMPERATURE]

Pierre Bristeau (Ph.D. Thesis--Paris Univ., 16 May 1968) Mar. 1969 107 p refs In FRENCH; ENGLISH summary

(CEA-R-3695) Avail: CFSTI

Experiments have been carried out on the total ionization by α particles, in pure gases and gaseous mixtures containing metastable atoms, as a function of temperature. Using a different experimental method, the results for the mean ionization energy at 300°K given by Jesse in 1953 have been confirmed to within 1 per cent. It is established that in pure gases the mean energy W required to form a pair of ions remains constant as the temperature varies from 77 to 300°K. It is shown that there is a temperature effect for W in binary gas mixtures of the type A-B containing metastable atoms A^* and an 'impurity' B. A systematic study is made of the change ΔW in W as a function of the temperature and of the B 'impurity' concentration in the mixtures Ne-Ar, Ne-Kr, Ne-HI2B, Ne-NI2B, Ne-CHI4B and He-Ar. Experiments have been carried out on a ternary gas mixture of the type A - B - C, where C is a second ionizable 'impurity' added to the binary mixture A - B; they show the existence of excited atoms B^* formed from the 'impurity' B. Finally, it is shown that the amount of metastable atoms formed in a pure gas must be very close to the number N_0 of ion pairs, and that there must exist a correlation between the number N_0 of ion pairs and the number N_0 of metastable atoms created in the pure rare gases. Author (ESRO)

N69-30012# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Metal Physics Branch.

THE EFFECT OF THE FAST NEUTRON SPECTRUM ON THE RATE AND DISTRIBUTION OF DAMAGE IN ZIRCONIUM

G. R. Piercy Feb. 1969 34 p refs Revised

(AECL-3086) Avail: Atomic Energy of Can., Ltd., Chalk River: $1.00

The damage rate produced by neutron irradiation of zirconium is calculated in terms of the energy given to the lattice. The effects of anisotropic elastic neutron scattering, inelastic neutron scattering, and energy loss to electron excitation using Lindhard's theory, are included. The results are applied to correlate the damage rate in seven different reactor spectra in terms of the associated ^{58}Ni monitor activity. The number of damage regions as a function of their lattice energy is also estimated and applied to several experiments. Author

N69-30015# International Centre for Theoretical Physics, Trieste (Italy).

THE PION CONSPIRATOR: FURTHER EVIDENCE OF ITS EXISTENCE AND A DISCUSSION OF ITS IMPLICATIONS IN MESON SPECTROSCOPY

P. di Vecchia (C.N.E.N.), F. Drago (C.N.E.N.), C. Ferro Fontan and R. Oborico, (Trieste Univ.) Jul. 1968 13 p refs Sponsored jointly by the AFOSR and Ist. Nazl. di Fis. Nucl. Submitted for publication

(IC/68/87) Avail: CFSTI

Earlier, strong evidence of the existence of a class III pion conspiracy in EGXBgpE +B photoproduction has been provided. This has been achieved by studying with the help of the continuous moment sum rules the amplitudes $F_2(-)$ and $F_3(-)$. Now evidence is presented for a Regge poles pion conspirator π_c. Analyzing by the same technique the amplitude $F_1(-)$ it is found that besides the A_2, a Regge pole with the same trajectory previously determined for π_c from the conspiring amplitude $F_3(-)$. This result confirms the existence of the pion conspirator Regge pole. Author (ESRO)

N69-30048# Rome Univ. (Italy). Physics Inst.

KINEMATICAL CONSTRAINTS AT T = 0 FOR REGULARIZED HELICITY AMPLITUDES: THE EQUAL--UNEQUAL MASS CASE

M. L. Paciello and B. Taglienti 2 Nov. 1968 8 p refs *Ita* Nota Interna 193

Avail: CFSTI

Using the behavior of the transversity amplitudes near t = 0 one finds that some linear combinations of regularized helicity amplitudes and their derivatives at that point must vanish. The calculation is performed for the EU mass case in the general spin configuration. Author (ESRO)

N69-30052# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France).

RADIATIVE CORRECTION TO THE GROUND-STATE ENERGY OF AN ELECTRON IN AN INTENSE MAGNETIC FIELD

B. Jancovici (1968) 3 p refs

(Rept-69/34) Avail: CFSTI

It is pointed out that the ground state energy of an electron does not deviate much from mc^2, even in the presence of intense magnetic fields larger by several orders of magnitude than 10^{13} gauss. Author

N69-30073*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.

A COMPARISON OF ROTATIONAL COLLISION NUMBERS OBTAINED FROM DIFFERENT DEFINITIONS

Frank J. Zeleznik Washington Jul. 1969 47 p refs

(NASA-TN-D-5321) Avail: CFSTI CSCL 20H

Two different definitions of rotational relaxation times were used to calculate rotational collision numbers for pure polar gases. One definition was based on the relaxation equation for rotational energy while the other was based on the connection between relaxation time and volume viscosity. For the purposes of the calculation, a polar molecule was taken to be a point dipole imbedded in a hard core and the interaction between molecules was confined to a plane. A classical calculation showed that the two definitions are equivalent, at least through the third order of a perturbation calculation. Both definitions predicted that increasing the temperature and decreasing the dipole moment and moment of inertia should increase the rotational collision number. The results are in qualitative agreement with experiment insofar as the dipole moment and moment of inertia dependence are concerned. No conclusion can be made concerning the correctness of the theoretical temperature dependence since the experimental temperature dependence is somewhat in doubt. Author

N69-30074*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXCITED STATES OF XENON-130 POPULATED BY BETA DECAY

Theodore E. Fessler, Glenn M. Julian, and S. Jha Washington Jul. 1969 19 p refs

(NASA-TN-D-5329) Avail: CFSTI CSCL 20H

Gamma rays emitted in the beta decay of 5^- ^{130}I and 1^+ ^{130}Cs have been studied with Ge(Li) and NaI(Tl) spectrometers. Twenty-four transitions were observed in the decay of ^{130}I, and 16 were observed in the decay of ^{130}Cs. From the gamma-ray singles spectra and from coincidence studies, the following excited levels of ^{130}Xe have been deduced: 536.1 (2^+), 1122.1 (2^+), 1204.8 (4^+), 1785.9, 1793.5, 1800.1, 1808.1, 1943.9 (5^+), 2016.1, 2150.6 2171.3, 2223.3, 2242.8, 2361.8 (6^+), 2427.0, 2532.3, 2608.6, and 2752.3 keV. No evidence has been found for the population of a possible 0^+ vibrational triplet member at about twice the energy of the first excited state. Author

N69-30076# Hungarian Academy of Sciences, Budapest.

GRAPHITE PRISM FOR APPLIED NEUTRON PHYSICAL MEASUREMENTS [GRAFIT PRIZMA ALKALMAZOTT NEUTRONFIZIKAI MERESEKHEZ]

Sandor Deme, Zsigmond Makra, and Zoltan Veres 1968 11 p refs In HUNGARIAN; ENGLISH summary

(NP-17787) Avail: AEC Depository Libraries

A graphite prism, with the dimensions 180 by 180 by 240 cm, is described. The prism will be used for applied neutron physical measurements, such as the calibration of detectors and the determination of the yield of neutron sources. By varying the location of the neutron source and/or the detector, the spectrum, as well as the flux of neutrons, can be varied in a wide range. The flux can be evaluated from the activation of foils, or when a source of known yield is used, by calculation. The prism is applicable for the intercomparison of various neutron sources. The prism will be used primarily for the calibration of neutron survey equipment covering a wide range of energies. Author (NSA)

N69-30077# California Univ., Los Angeles.

QUARK MODEL RELATIONS FOR HIGH ENERGY DIFFRACTION SCATTERING

H. Satz Jul. 1968 9 p refs Sponsored in part by NSF

Avail: Issuing Activity

Asymptotic relations connecting both the diffraction slopes and the opacities for various measured meson– and nucleon–nucleon interactions were obtained by combining an additive quark picture for inelastic reactions with a diffraction model. The reason for applying a quark picture to inelastic processes was twofold: (1) to construct an experimental model which gives well-satisfied sum rules to connect multiparticle production reactions; and (2) and to further investigate the hypothesis that high energy elastic diffraction scattering is a shadow effect of all inelastic channels. The established relations were verified by existing high energy data. A.C.R.

N69-30082# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.

STUDY OF THE ARTIFICIAL RADIOACTIVITY OF THE MARINE MEDIUM USING GAMMA SPECTROMETRY (1962–1968) [ETUDE DE LA RADIOACTIVITE ARTIFICIELLE DU MILIEU MARIN PAR SPECTROMETRIE GAMMA (1962–1968)]

Roger Chesselet Mar. 1969 115 p refs In FRENCH; ENGLISH summary

(CEA-R-3698) Avail: CFSTI

This study concerns the artificial radioactivity of such elements as zirconium 95, niobium 95, ruthenium 103, ruthenium 106, cerium 141, cerium 144 and praseodymium 144 which were present in the atmospheric fallout between 1962 and 1964, and their incidence in superficial marine waters. Various physical, chemical and biological processes were studied by a high sensitivity gamma ray spectrometry technique, using those radioelements as "tracers". A description of the unexpected change of state in sea water of an important fraction (about 50 per cent) of the radioactive particles going into the soluble phase controls the processes of accumulation in the planktonic biomass and the diffusion towards deeper waters is given. A description is also given of an 'in situ' spectrometry method for direct measurement of very low concentrations of some gamma ray emitters in the sea and numerous observations in the surface waters of the Western Mediterranean Sea and in the Bay of Biscay. It is shown that the mixing depth is closely connected to the depth of the thermocline and an accumulation process takes place there. The diffusion coefficients are similar to the thermal turbulent coefficient. 'Compartments' exist for several months in the surface waters of the Bay of Biscay. A comparative study shows that the rate of radioactive fallout on the maritime zone considered is always two to three times higher than that on the neighboring continental regions and several explanations of this phenomenon are discussed. Author (ESRO)

N69-30100# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.

BIBLIOGRAPHIC STUDY OF THE AVERAGE ENERGY LOST BY ELECTRONS TO FORM AN ION-PAIR IN AIR [ETUDE BIBLIOGRAPHIQUE DE L'ENERGIE MOYENNE DEPENSEE PAR LES ELECTRONS POUR CREER UNE PAIRE D'IONS DANS L'AIR]

Evelyne Bertel Mar 1969 12 p refs In FRENCH; ENGLISH summary

(CEA-BIB-144) Avail: CFSTI

A critical study of the most important experiment carried out on the average energy lost in producing one ion-pair in air is presented. This study enables one to find the best methods in use. Experimental results used to determine the value adopted by the I.C.R.U. in 1964 and still in use are noted. The reference list gives the most important reports in the literature. Author (ESRO)

N69-30104# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).

DIFFUSION OF THE SYSTEM (MESON-PROTON) IN GASEOUS HYDROGEN [DIFFUSIONE DEL SISTEMA (MESON-PROTON) IN IDROGENOGASSOSO]

G. Matone 1969 44 p refs In ITALIAN *Its* Nota Interna No. 428

(LNF-69/5) Avail: CFSTI

The process of slow muon μ-capture in gaseous hydrogen is studied. Consideration is limited to the inelastic and elastic scattering processes of the system μ-p with the hydrogen molecule, neglecting the processes that eventually transform the μ to an impurity in the gas, or the formation of the molecular ion $(p\mu p)^+$. The results of using the Monte Carlo method for calculating the spatial distribution of the triplet state of the system (μ-p) in gaseous hydrogen at various pressures and ambient temperatures are reported. Transl. by F.O.S.

N69-30105# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).

MONTE CARLO TYPE PROGRAM FOR THE SIMULATION OF EVENTS PRODUCED IN ADDITION TO THE REGULAR REACTIONS WITH MAGNETIC ANALYSIS [PROGRAMMA DI TIPO MONTECARLO PER LA SIMULAZIONE DI EVENTI PRODOTTI IN ADONE IN UN DISPOSITIUO CON ANALISI MAGNETICA]

M. A. Locci, M. A. Mencuccini-Speno, M. Nigro, and R. Santangelo 3 Mar. 1969 33 p refs In ITALIAN *Its* Nota Interna No. 435

(LNF-69/13) Avail: CFSTI

A FORTRAN 4 program is written for the analysis of the e^+e^- reaction. The apparatus consists of a cylindrical spool with an induction field in the center, and scintillating cameras inside and outside the spool. The program explains the following principle phases: (1) generation of an event of the type $e^+e^- \rightarrow A+B+C...$ with a statistical model; (2) evaluation of each event for moment and direction, and assignment of a calculated weight based on the dynamics; (3) simulation of the deformations of the moment and direction for maintaining the count; (4) verification that particles enter the zone of sensitivity of the apparatus, and calculation of the efficiency of the count; and (5) tape recording of all information of the events. Transl. by F.O.S.

N69-30113# International Centre for Theoretical Physics, Trieste (Italy).

FINITE ENERGY SUM RULES AND ρ NN COUPLINGS

R. F. Amann (Chicago Univ.) Jun. 1968 7 p refs Supported jointly by the NSG and the AEC Submitted for publication

(IC-68-49) Avail: CFSTI

Finite energy sum rules for backward πN scattering are used to suggest new values for the ρNN couplings. These couplings improve the predictions of the ρ dominance model for the πN amplitudes at threshold and for the electromagnetic radii of the nucleon. Author (ESRO)

N69-30116# Kitt Peak National Observatory, Tucson, Ariz. Space Div.

THE ELECTRONIC TRANSITION MOMENT FOR THE N SUB 2 VEGARD-KAPLAN BANDS

A. L. Broadfoot and S. P. Maran [1969] 13 p refs Sponsored by NSF *Its* Contrib. No. 000

Avail: CFSTI

Measurements of relative band intensities for the N_2 Vegard–Kaplan bands with $v' = 0$ are used to find a curve that represents the smooth variation of the electronic transition moment with internuclear separation. Author

N69-30125# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.

PADE APPROXIMATIONS IN FIELD THEORY: PION AND KAON SYSTEMS. [APPROXIMANTS DE PADE EN THEORIE DES CHAMPS: SYSTEME DE PIONS ET DE KAONS]

Jean Zinn-Justin (Ph.D. Thesis–Paris Univ., 18 Dec. 1968) Mar. 1969 93 p refs In FRENCH; ENGLISH summary

(CEA-R-3763) Avail: CFSTI

Pade approximations of the S-matrix, based on the perturbation series and using three parameters, have been constructed for two body pion and kaon systems. The seven lowest lying two body resonances (ρ, $K^*(890)$, ψ, $K^*(1420)$, f_0, f', A_2) are obtained within a few per cent of their actual masses. The Regge trajectories are rising and the intercepts of ρ and f_0 agree well with the experimental values. In the appendices some properties and applications of Pade approximations are given. Author (ESRO)

N69-30127# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.

PHONONS AND THE THERMODYNAMIC PROPERTIES OF SURFACES. [LES PHONONS ET LES PROPRIETES THERMODYNAMIQUES DES SURFACES]

Léonard L. Levenson Feb. 1969 22 p refs In FRENCH; ENGLISH summary

(CEA-BIB-142) Avail: CFSTI

Various treatments of the problem are first reviewed and the analysis is then concentrated on the general theories which yield an evaluation of the surface vibration contribution to the thermodynamic properties of matter. The calculated values of the free energy, energy, entropy and heat capacity of the surface are then compared with available experimental values. The orders of magnitude are satisfactory, but major improvements of the theories must be made in order to reach quantitative agreement. Author (ESRO)

N69-30158# International Centre for Theoretical Physics, Trieste (Italy).

EFFECTIVE N-N INTERACTION AND ELECTROMAGNETIC OPERATORS DEDUCED FROM THE TABAKIN POTENTIAL: APPLICATION TO NICKEL ISOTOPES

R. Alzetta (Trieste Univ.), A. Rimini (Trieste Univ.) T. Weber (Trieste Univ.), M. Gmitro, and J. Sawicki Jan. 1969 32 p refs Submitted for publication Sponsored partly by Ist. Nazl. di Fis. Nucl.

(IC/69/2) Avail: CFSTI

The properties of low-lying states of even and odd nickel isotopes are derived by means of the quasiparticle second Tamm-Dancoff theories in the frame of mixed configurations. The Tabakin potential renormalized for particle-hole excitations of the core is used. The agreement between theoretical and experimental spectra is good for Ni 58–60 but becomes worse for Ni 61–64. Calculated effective electromagnetic operators are used to compute E2 and M1 transition rates, E2 and M1 static moments and inelastic electron scattering form factors. The theory fails in the case of the E2 operator, while it is successful for the M1 operator. Spectroscopic factors for one-nucleon transfer reactions are calculated and found to be in general agreement with experiment. Author (ESRO)

N69-30157# International Centre for Theoretical Physics, Trieste (Italy).

INDETERMINACY POINTS IN POTENTIAL SCATTERING

H. H. Aly, K. Schilcher, and H. J. W. Müller (Munich Univ.) Jan. 1969 10 p refs Submitted for publication

(IC/69/4) Avail: CFSTI

Concise expressions for the S-matrix of Yukawa and Gauss-like potentials are used to investigate the characteristics and location of indeterminacy points. Accurate numerical results are obtained in a simple way and compared with earlier results. Author (ESRO)

N69-30156# International Centre for Theoretical Physics, Trieste (Italy).

A = 21 NUCLEI IN THE SU_3 MODEL

M. Sotona (Nucl. Res. Inst., Prague), M. Gmitro, Z. Pluhar (Prague Univ.), and L. Trlifaj (Nucl. Res. Inst., Prague) Jan. 1969 37 p refs Submitted for publication

(IC/69/5) Avail: CFSTI

The nuclear SU_3 model is used to describe the basic characteristics of nuclei with A = 21. The use of the phenomenological residual interaction (Barker-Gauss and Serber-Yukawa) gives only unsatisfactory agreement with experiment. The residual interactions derived from the Hamada-Johnston and Tabakin realistic potentials after introducing renormalization corrections with three particles and one hole, with two particles and with two holes in the intermediate states produce Ne 21 and Na 21 spectra in satisfactory agreement with experiment and also confirm the equivalence of these potentials. Most of the electromagnetic characteristics of these nuclei are described very well in the model used. Author (ESRO)

N69-30159# International Centre for Theoretical Physics, Trieste (Italy).

REGGEIZATION IN SUPERMULTIPLET THEORIES

R. Delbourgo (Imp. Coll., London), and Abdus Salam Jan. 1969 40 p refs Submitted for publication

(IC/69/1) Avail: CFSTI

Methods for incorporating higher symmetry ideas into the phenomenology of Regge poles are reviewed. These methods, which were developed originally for treating models of the 'quark excitation' type, are extended to cover also the 'orbital excitation' models with particular reference to the oscillator model. Author (ESRO)

N69-30192# Comitato Nazionale per l'Energia Nucleare, Rome (Italy). Laboratori Nazionali di Frascati.
ELECTRON POSITRON STORAGE RINGS: STATUS AND PRESENT LIMITATIONS
F. Amman 28 Feb. 1969 10 p refs Presented at the Natl. Particle Accelerator Conf., Washington, D.C., 5–7 Mar. 1969 *Its* Internal Note No. 434
(LNF-69/12) Avail: CFSTI

A review of the current status of electron and positron storage rings is presented. The experimental results on beam instabilities, their consequences on the design of a high current storage ring, and the technological problems involved are discussed. Author

N69-30205# Laboratoire de Physique Theorique et des Hautes Energies, Orsay (France). Faculte des Sciences.
FINAL STATE INTERACTION AND CURRENT ALGEBRA IN K SUB 3 PI AND ETA SUB 3 PI DECAYS
A. Neveu and J. Scherk May 1969 37 p refs
(Rept-69/29) Avail: CFSTI

In a simple model of final state interaction, the validity of the linear extrapolation in $K \rightarrow 3\pi$ and $\eta \rightarrow 3\pi$ decays was discussed. Final state interaction modifies the extrapolation between the physical points where the soft pion approximation is valid by introducing quadratic and higher terms in the amplitude. Computation of the effect in the frame of the Khuri-Treiman equation showed that they are dominated by the $\pi\pi$ scattering in each of the two pions subchannels, so that the corrections come out mainly from two-body scattering effects. Comparison with current algebra, Venziano model and experiment for the rates, slopes, quadratic terms in $K \rightarrow 3\pi$ and $\eta \rightarrow 3\pi$ decays is given. Author

N69-30269# National Bureau of Standards, Washington, D.C.
BIBLIOGRAPHY ON THE ANALYSES OF OPTICAL ATOMIC SPECTRA, SECTION 5
Charlotte E. Moore May 1969 42 p refs
(NBS-SD-306-3) Avail: SOD $.50

The three published volumes on Atomic Energy Levels, NBS Circ. 467, contain for each spectrum the bibliography that was used in compiling the data. The present work is a continuation of these bibliographies arranged in the same form. The time interval is the span from the respective dates of the earlier publications to the present. The selection of references is restricted to those needed for the preparation of revised tables of atomic energy levels and multiplets. The bibliography is being published by Sections, each of which covers the same elements as the respective volumes of AEL. The present Section gives references to the spectra of the elements, ^{42}Mo through ^{57}La and ^{72}Hf through ^{89}Ac. For a given element the spectra are listed in order of increasing stage of ionization. Author

N69-30270# Comitato Nazionale per l'Energia Nucleare, Rome (Italy). Laboratori Nazionali di Frascati.
LORENTZ EXPANSION FOR THE VENEZIANO AMPLITUDE
P. DiVecchia, F. Drago, and S. Ferrara 13 Mar. 1969 7 p refs *Its* Internal Note No. 437
(Contract F61052-67-C-0084)
(LNF-69/17) Avail: CFSTI

The Veneziano amplitude is projected on the irreducible representations of the Lorentz group. An infinite sequence of Toller poles, as well as an essential singularity as $\lambda \rightarrow \infty$, is shown to be present. The residues of the Toller poles, with the exception of the first, do not factorize. Author

N69-30298# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
SPECTROMETRIC CHARACTERISTICS OF THE γ EMISSION OF FISSION PRODUCTS; ANALYSIS OF IRRADIATED URANIUM WITH A 'GERMANIUM-LITHIUM' DETECTOR [CARACTERISTIQUES SPECTROMETRIQUES DE L'EMISSION γ DES PRODUITS DE FISSION: ANALYSE AVEC UN DETECTEUR 'GERMANIUM-LITHIUM' D'UN URANIUM IRRADIE]
Pierre-Louis Chevillon-Pitollat and Raymond Pannetier Mar. 1969 42 p refs In FRENCH; ENGLISH summary
(CEA-R-3777) Avail: CFSTI

In order to study the γ-ray spectra of atmospheric aerosol samples obtained with Ge-Li detectors, the spectrometric characteristics of fission product γ-ray emission had first to be specified by analyzing the evolution with time of the spectra of irradiated uranium. Author (ESRO)

N69-30306# Comitato Nazionale per l'Energia Nucleare, Rome (Italy). Laboratori Nazionali di Frascati.
THE RHO GAMMA COUPLING AND THE OPTICAL MODEL
R. Wilson 4 Apr. 1969 9 p refs *Its* Internal Note No. 438
(LNF-69/18) Avail: CFSTI

Recent attempts to measure the rho-meson nuclear coupling constant and the nucleon total cross section by photoproduction in complex nuclei are discussed, and the discrepancies between the obtained results are analyzed. Possible causes of the differences, with recommendations for obtaining consistent data, are included. A.C.R.

N69-30307# Comitato Nazionale per l'Energia Nucleare, Rome (Italy). Laboratori Nazionali di Frascati.
PHOTOPRODUCTION OF THE ETA MESON ON DEUTERIUM
C. Bacci 13 Feb. 1969 7 p refs *Its* Internal Note No. 432
(LNF-69/9) Avail: CFSTI

Inelastic photoproduction of the eta-meson on deuterium was performed using a 1.1 GeV electron synchrotron in order to make a direct comparison between the eta photoproduction cross sections for deuterium and hydrogen. These reactions were studied to obtain information concerning the relative properties of photoproduction from protons and neutrons, from which the relative contributions of the isoscalar and isovector parts of the eta photoproduction amplitudes may be deduced. The results indicated that the cross sectional ratio for eta-meson photoproduction on deuterium and that for the same reaction on free protons is about two and does not depend on angle. It was therefore concluded that the neutron and proton cross sections are very similar and consistent, with a center-of-mass angular distribution that is essentially isotropic. A.C.R.

N69-30308# Comitato Nazionale per l'Energia Nucleare, Rome (Italy). Laboratori Nazionali di Frascati.
PROPOSAL FOR A STUDY OF BOSON PRODUCTION AT ADONE USING MAGNETIC ANALYSIS
W. Ash, G. Goggi, D. Grossman, G. P. Murtas, M. Nigro et al 27 Jan. 1969 25 p refs *Its* Internal Note No. 429
(LNF-69/8) Avail: CFSTI

Decay modes of 1^- (vector) mesons produced by e^+e^- annihilation in storage rings and the production of meson resonanc

pairs which yield a final state of bosons and photons were studied. Significant information concerning the dynamics of the e+e⁻ → bosons interactions was obtained using a magnetic analyzer designed for colliding beam experiments. A.C.R.

N69-30310# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
EFFICIENCY MEASUREMENT OF A SCINTILLATION CHAMBER AS A FUNCTION OF THE SPECIFIC IONIZATION OF THE PARTICLES [MISURE DI EFFICIENZA DI CAMERE A SCINTILLA IN FUNZIONE DELLA IONIZZAZIONE SPECIFICA DELLE PARTICELLE]
M. Grilli, P. Spillantini, and R. Visentin 7 Mar. 1969 13 p refs In ITALIAN *Its* Nota Interna No. 436
(LNF-69/16) Avail: CFSTI

The difference in ionization rates of the particles being detected and the minimum rate of ionization in a scintillation chamber are studied. It is shown that an interval exists between the two rates, and a formula is given for the efficiency determination. The discrimination depends on the value of the specific ionization of the particles being detected or counted, and the concentration in the chamber. The work is compared briefly with that of other authors. Tables of results are presented. Transl. by F.O.S.

N69-30321# Comitato Nazionale per l'Energia Nucleare, Frascati (Italy).
THE TRANSPORT CHANNELS OF THE EXTRACT BUNDLE FOR THE FRASCATI ELECTROSYNCHROTRON [I CANALI DI TRASPORTO DEL FASCIO ESTRATTO DELL'ELETTROSINCROTRONE DI FRASCATI]
U. Bizzarri and T. Letardi 1969 22 p refs In ITALIAN *Its* Nota Interna No. 431
(LNF-69/8) Avail: CFSTI

A description of the Frascati synchrotron extraction channels is presented. Included are: (1) production of electron bundles, (2) characteristics of the extraction bundle, (3) plan of the transport canals, (4) detailed descriptions of channels N. 1, 2, and 3, and (5) characteristics and measurement of optical properties. Charts and tables showing profiles of canal energies are presented. Transl. by F.O.S.

N69-30347# Joint Inst. for Nuclear Research, Dubna (USSR). Lab. of Theoretical Physics.
PRODUCTION OF MULTIPLY CHARGED FRAGMENTS IN INTERACTIONS OF HIGH-ENERGY PARTICLES WITH NUCLEI
S. M. Eliseev 1968 60 p refs In RUSSIAN
(JINR-P2-4160) Avail: AEC Depository Libraries

Experimental data and various fragmentation theories in the high-energy region are reviewed. Author (NSA)

N69-30365# Montpellier Univ. (France). Department de Physique Mathematique.
AN ANALYSIS OF THE REACTION POSITIVE ELECTRON NEGATIVE ELECTRON YIELDS POSITIVE PION NEGATIVE PION GAMMA AND POSITIVE ELECTRON NEGATIVE ELECTRON YIELDS NEUTRAL PION PLUS OMEGA (POSITIVE PION NEGATIVE PION NEUTRAL PION)
F. M. Renard Apr. 1969 32 p refs
(PM/69/2) Avail: CFSTI

In the framework of the vector dominance model these reactions are analyzed in view of the determination of the coupling constants and of the parameters of possible σ-terms. Author

N69-30367# Atomic Energy of Canada, Ltd., Chalk River (Ontario). Physics Div.
PHYSICS DIVISION Progress Report, 1 Jan.–31 Mar. 1969
31 Mar. 1969 91 p
(AECL-3333; PR-P-81) Avail: Atomic Energy of Can., Ltd., Chalk River: $2.00

Progress reported covers nuclear physics research on excited states of silicon, sulfur, lead, gold, zirconium, and bismuth. Solid state studies encompassed measurements of neutron scattering and annihilation gamma rays as well as the testing of radiation detectors made from germanium–lithium crystals. A computer program has been written for the analysis of gamma-ray spectra. G.G.

N69-30377# Comitato Nazionale per l'Energia Nucleare, Rome (Italy). Laboratori Nazionali di Frascati.
NEUTRON SPECTRUM FROM THE 4.43 MeV LEVEL OF THE C SUP 12 IN A Po-Be SOURCE
R. Del Fabro, G. Matone, and M. Roccella 20 Feb. 1969 14 p refs Submitted for publication *Its* Internal Note No. 433
(LNF-69/11) Avail: CFSTI

A time-of-flight technique was used to measure the neutron spectrum of a Po–Be source. In this method the starting signal is given by a photon from a 4.43 MeV level of C^{12} from which the central group neutrons, whose detailed spectra have been obtained, are selected. The effective contribution of the neutrons in such a group can thus be evaluated due to the secondary process in the low energy region. A description of the experimental apparatus is given, followed by an evaluation of neutron detector efficiency. Results were recorded for neutron spectra in the range between 2 and 6 MeV, and under 2 MeV; these data are analyzed as related to theoretical calculations, elastic and anelastic scattering processes in the source, and the overall relationship between low energy neutrons and secondary effects. It is concluded that the latter relationship can completely alter the neutron spectrum coming from the 7.65 MeV level of C^{12}, insofar as the small Po–Be sources used in the present experiment are concerned. A.C.R.

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N69-29044# Innsbruck Univ. (Austria). Inst. for Theoretical Physics.
A GENERAL ALGORITHM FOR THE INVESTIGATION OF PLASMA INSTABILITIES
Dietmar Floriani 31 Jan. 1969 14 p refs
(Contract F61052-67-C-0014)
(AD-684545; UNICP-SR62; AFOSR-69-0737TR) Avail: CFSTI CSCL 20/9

A method is proposed which uses the expansion of all quantities into series of powers of time t. It is not difficult to give the general recurrence formulas, although dissipative effects and external forces are included simultaneously. The connection to the normal mode method and to statistics is given. This algorithm should be most powerful for the computation of the initial time behavior of a plasma system. Author (TAB)

N69-29048# RAND Corp., Santa Monica, Calif.
GEOMETRICAL CALCULATION OF CROSS-POLARIZATION EFFECTS IN ELECTROMAGNETIC BACK-SCATTERING
S. D. Bloom and S. A. Moszkowski Jan. 1969 42 p refs
(Contract F44620-67-C-0045; Proj. RAND)
(AD-684150; RM-5882-PR) Avail: CFSTI CSCL 17/9

The report describes the cross-polarized return for backscattering of polarized radar pulses by a turbulent plasma. A general expression of the second order backscattered and cross-polarized cross section is derived, using arguments from geometrical optics. Then, the results for linear and circular polarized waves are compared. One finds that for scattering by a cylindrical medium with the axis parallel to the direction of the radar pulse, the cross section is twice as large for circular polarization as for linear polarization. The dependence of this ratio on the relative orientation angle of the beam axis and cylinder axis is considered, as is the dependence of this ratio on the autocorrelation function in the turbulent medium. It is shown that the scattering cross section of a polarized beam by a medium, as discussed in the text, is identical to the long wavelength limit of the quantum mechanical formula for the Crompton cross section. Author (TAB)

N69-29129 Northwestern Univ., Evanston, Ill.
DIRECT INTEGRATION OF THE TIME-DEPENDENT MAXWELL'S EQUATIONS
Oded Ben-Dov (Ph.D. Thesis) 1968 94 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 69-1796

The integration of Maxwell's equations in both bounded and unbounded media is discussed. The sources exciting the electromagnetic fields are assumed to be of arbitrary spatial and temporal dependence. This work uses Green's dyadics which are given completely in the time domain, for three different media: free space (except for the sources), conducting media (with constant conductivity), and plasma (linearized hydrodynamic model). In the classical sense, proofs cannot be given that the dyadics derived for the three media satisfy the appropriate dyadic wave equations and the associated initial conditions. For this reason, and in order to give meaning to Maxwell's equations at points of discontinuities, a mathematical section on distribution theory and its relation to Maxwell's equations is included. An integral equation is derived for the normal component of the velocity of the electron fluid at the interface, and, subsequently, a variational principle for this velocity is given. Experimental results are cited to support the form of the Green's dyadic for the total field in a plasma. Finally, the velocity field excited by a modulated moving source in a half space is evaluated. Dissert. Abstr.

N69-29140*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
PLASMA GENERATION USING A LARGE V-GROOVE CATHODE DISCHARGE
Paul R. Caron Washington Jun. 1969 37 p refs
(NASA-TN-D-5269) Avail: CFSTI CSCL 20I

The results of an investigation of the plasma parameters generated by a large V-groove cathode discharge are presented. The cathode consists of a 12-inch aluminum plate into which V-grooves of 1/8-inch spacing and 60-deg angle are milled. With this cathode, a negative glow discharge is produced which yields a stable, steady-state plasma. Electron densities up to 2×10^{12} cm^{-3} have been obtained in the 12-inch diameter chamber. The electron temperature is about 1200°K and is independent of discharge current and gas pressure over the range 0.3 to 1.0 torr. The discharge operates in much the same fashion as a conventional brush cathode discharge but with lower operating voltage for equal current densities. The lower operating voltage, which reduces the arcing problems at the cathode-glass junction, and the relative ease in fabricating the V-groove cathode make it an attractive alternative to the brush cathode for many applications. Author

N69-29240 Kansas Univ., Kansas City.
NUMERICAL SOLUTIONS OF ELECTROMAGNETIC WAVES IN INHOMOGENEOUS MAGNETO-PLASMA SLABS
Dikshitulu K. Kalluri (Ph.D. Thesis) 1968 279 p
Avail: Univ. Microfilms: HC $12.60/Microfilm $3.60 Order No. 68-17407

The numerical solution for the reflection, transmission, and absorption coefficients is derived for the case of oblique incidence of an arbitrary polarized free space plane wave on a warm magneto-plasma slab with arbitrarily directed static magnetic field. The solution for waves in inhomogeneous warm magneto-plasma slab for oblique incidence is obtained by two methods. In the sub-slab method, the plasma slab is horizontally stratified. The full wave solution is obtained by developing the first order coupled differential equations in the variables E_x, E_y, H_x, H_y, u_z and p. Adams–Moulton predictor–corrector method is used for the numerical integration of the differential equations. Numerical results are obtained for linear, parabolic, and exponential electron density profiles and are presented in terms of parameters normalized with respect to the plasma frequency at the middle of the slab. The effect of ion motion on the waves is also examined. Dissert. Abstr.

N69-29261 City Univ. of New York.
THEORETICAL AND EXPERIMENTAL INVESTIGATION OF PLASMA FLUTE MODES IN A NONUNIFORM ELECTRIC FIELD
Gerald I. Kent 1968 109 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-15935

Experiments were performed with low-beta alkali metal plasmas produced in a Q-machine. The flutes propagate azimuthally and have maximum amplitude near the plasma column edge where a large radial electric field, E_r, exists. The $E_r \times B$ drift velocity produces an instability similar to the Kelvin-Helmholtz instability. Consideration of adjacent regions undergoing rigid body rotations and having constant density leads to an expression for the oscillation frequencies and a stability criterion are discussed. Theoretical results show that velocity shear is the mechanism which drives the instability, but centrifugal effects are also destabilizing. Finite Larmor terms stabilize short wavelengths as for the gravitational flute instability. If the experiment is interpreted in light of the present theory, the oscillation frequencies, stability conditions and radial amplitude distributions compare favorably. Dissert. Abstr.

N69-29312# Michigan Univ., Ann Arbor.
MICROINSTABILITIES IN INHOMOGENEOUS PLASMA Progress Report, 1 May 1968–31 Jan. 1969
Terry Kammash Jan. 1969 8 p refs
(Contract AT(11-1)-1478)
(COO-1478-5) Avail: CFSTI

Research work carried out during this period is briefly discussed for the following: (1) shear stabilization of drift cyclotron modes, (2) ion cyclotron instabilities in confined plasma, (3) flute-like instabilities in plasma with a cylindrical relativistic electron beam, (4) convective and absolute ion cyclotron instabilities, and (5) non-linear studies. A list of papers published in the open literature during the period is included. NSA

N69-29334 Stanford Univ., Calif.
RF DEFOCUSING OF A SELF-FOCUSED BEAM IN A BEAM-GENERATED PLASMA
Barry Winston Stallard (Ph.D. Thesis) 1968 92 p
Avail: Univ. Microfilms: HC $4.80/Microfilm $3.00 Order No. 69-296

The experiments performed verify the importance of the growing transverse mode in defocusing electrostatically pinched beams. Good agreement is obtained between experiment and the defocusing length predicted by theory. Several other significant results are observed. There are measured increases along the beam of plasma electron temperature. On this basis, equilibrium theory predicts a shortening of the length for beam pinching and a

decrease in plasma density. Experimental observations of these two effects are in agreement with the theory. Also observed is a variation in gain along the pinched beam, with a period equal to the distance between adjacent minima in the beam radius. This effect is predicted by theory and results from a variation in beam density due to pinching. Dissert. Abstr.

N69-29367# Akademiya Nauk UrSR, Kharkov. Fiziko-Teknicheskii Institut.
DETERMINATION OF THE LOCAL VALUES OF PLASMA PARAMETERS BY THE ENERGY ABSORPTION OF A REFRACTING MICROWAVE BEAM
L. A. Dushin, V. A. Pimkin, A. I. Skibenko, and I. P. Fomin 1968 14 p refs In RUSSIAN
(NP-17785) Avail: AEC Depository Libraries

An experimental determination of the electron density and temperature distribution by the radius of the pulsed reflecting discharge in a decaying plasma is described. A method of microwave probing of the plasma cylinder in the cross section at different angles to the interface was used in the measurements. Author (NSA)

N69-29441# Stanford Univ., Calif. Inst. for Plasma Research.
NONLINEAR INTERACTION BETWEEN EXTRAORDINARY WAVES IN A COLD PLASMA
K. J. Harker and F. W. Crawford Dec. 1968 44 p refs
(Contract AT(04-3)-326)
(SU-IPR-264) Avail: CFSTI

An analysis was made of the nonlinear interaction between extraordinary waves propagating perpendicular to the static magnetic field in a cold homogeneous magnetoplasma. It is first shown that the synchronism conditions for wave–wave interactions can be met over wide ranges of parameters. A theory of the interaction based on cold plasma theory is then described which yields a closed-form solution for signal growth by the mechanism of parametric amplification. Numerical solutions are presented for the growth rate and associated frequencies and wave numbers over a range of magnetoplasma parameters. The relevance of these results to laboratory and space plasma experimentation, and to verification of the theory, is discussed. Author (NSA)

N69-29453 Washington Univ., Seattle.
DISSIPATIVE EFFECTS IN COMPRESSIBLE MAGNETOHYDRODYNAMIC FLOW
Louis Bernard Gratzer (Ph.D. Thesis) 1968 145 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-1174

A general approach to the study of compressible dissipative magnetohydrodynamic (MHD) flow is developed based on the linearized MHD equations for a flow with small perturbations in a uniform stream with constant applied magnetic field. No restriction is placed on the range or values of the important physical parameters such as viscosity, heat conductivity, electrical conductivity, compressibility, etc. The general solution of the MHD equations is presented and shown to be applicable to any physical problem characterized by equations of this type. The concept of the fundamental modes corresponding to sources of the MHD equations is developed as a basis for treating boundary value problems within the framework of the linearized theory. The study of the fundamental modes is found to provide an ideal basis for understanding the influence of the various flow parameters; i.e., Reynolds number, Mach number, Prandtl number, Magnetic Prandtl number, Alfven number and magnetic field direction. Dissert. Abstr.

N69-29548# Sydney Univ. (Australia). School of Physics.
PLASMA PHYSICS Six-Monthly Progress Report No. 18, 1 Jul.- 31 Dec. 1968
31 Dec. 1968 8 p refs
(NP-17775; PR-18) Avail: AEC Depository Libraries

A very brief outline of research carried out at Sydney during this period is given. The research was done on the SUPPER devices and laser devices. NSA

N69-29600*# National Aeronautics and Space Administration. Electronics Research Center, Cambridge, Mass.
A LABORATORY STUDY OF MICROWAVE RADIOMETRIC TECHNIQUES FOR RE-ENTRY PLASMA MEASUREMENTS
P. R. Caron, G. Heroules, W. Brown, III, and F. Russo Washington Jul. 1969 35 p refs
(NASA-TN-D-5274) Avail: CFSTI CSCL 20I

The results of a laboratory study of plasma radiometric techniques applicable to reentry plasma measurements are presented. The laboratory plasma is generated by a glow discharge in helium using a large V-groove cathode. The operating characteristics of the discharge are quite similar to those of the brush cathode discharge. The electron density and temperature are determined as a function of position, discharge current, and gas pressure using Langmuir probes and microwave reflectometers, and the collision frequency is calculated using these measured values. The plasma noise radiation is measured as a function of discharge current using a microwave radiometer operating in the absolute mode. It is shown that numerical values of electron density, collision frequency, and electron temperature can be derived from curves of plasma noise as a function of discharge current. Author

N69-29617# Centre de Recherches en Physique des Plasmas, Lausanne (Switzerland).
SPECTROSCOPIC OBSERVATION OF IMPURITIES IN A PLASMA PULSE AND ION TEMPERATURE MEASUREMENTS [OBSERVATIONS SPECTROSCOPIQUES DES IMPURETES DANS UN PLASMA PULSE ET MESURES ET TEMPERATURE IONIQUES]
A. Bemey Dec. 1968 59 p refs In FRENCH; ENGLISH summary
(LRP-39/68) Avail: AEC Depository Libraries

Spectroscopic measurements were made in a plasma produced by an axial preionization discharge followed by a rf rotating magnetic field pinch. General observations about impurities are presented, concerning both discharges. Ion temperature measurements in the preionized plasma are reported. Spectral lines of O+, Ar+, N+ and N++ were analyzed with a multichannel Fabry–Perot interferometer. The lines widths and shifts are related to the ion temperatures of the different species and to large-scale turbulence motions in the plasma. Author (NSA)

N69-29685 Stanford Univ., Calif.
TRANSPORT COEFFICIENTS OF PARTIALLY IONIZED PLASMAS IN A MAGNETIC FIELD
Chien-peng Li (Ph.D. Thesis) 1968 115 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 69-250

Complete formulas for the calculation of the transport coefficients of a stable, multicomponent plasma in the presence of a magnetic and an alternating electric field are developed in accordance with the Chapmen-Enskog theory. Special forms are derived for application to computing the electron transport coefficients of laboratory plasmas where the species interact with realistic potentials. The rate of convergence of successive approximations is examined up to sixth order for the transverse and the Hall components of these coefficients. It appears that sixth approximation of the polynomial expension scheme is well suited for plasmas in an electromagnetic field, but higher approximation is needed to account for the electron-atom Ramsauer phenomenon. Less exact methods such as the Frost mixture rule and the perturbation

method are extended to the calculation of thermal conductivity parallel to the field. Numerical values of electrical and electron thermal conductivities for helium and argon are evaluated by the three methods mentioned above and are compared.
Dissert. Abstr.

N69-29786# Boeing Scientific Research Labs., Seattle, Wash. Plasma Physics Lab.
THE RELATIONSHIP BETWEEN MICROWAVE EMISSION FROM In Sb WITH AND WITHOUT MAGNETIC FIELDS
Betsy Ancker-Johnson Apr. 1969 30 p refs Sponsored in part by NSF
(DI-82-0835) Avail: Issuing Activity

No differences in the emission produced with and without magnetic fields are observed other than the level of intensity which appears to be controlled primarily by the density of the plasma in the region of the sample able to contribute to the transmitted radiation.
Author

N69-29787# Boeing Scientific Research Labs., Seattle, Wash. Plasma Physics Lab.
STUDIES OF VLF RADIATION PATTERNS OF A DIPOLE IMMERSED IN A LOSSY MAGNETOPLASMA
D. P. Gia Russo and J. E. Bergeson Mar. 1969 48 p refs
(DI-82-0797) Avail: Issuing Activity

Power patterns are presented for VLF radiation (500 Hz to 30 kHz) from magnetic and electric dipole sources in a two-component lossy magnetoplasma. The patterns show that energy tends to be transported primarily along the the magnetic axis of a confinement cone for higher VLF frequencies, but that the inclusion of ion motion destroys the confinement cone for extremely low frequencies.
Author

N69-29905*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ENERGY TRANSFER AND ION COST IN A HYDROGEN PLASMA
Carl F. Monnin and George M. Prok Washington Jul. 1969 19 p refs
(NASA-TN-D-5319) Avail: CFSTI CSCL 20I

A Maxwellian electron gas interacts with a cold neutral hydrogen gas with various degrees of dissociation. The electron temperature range is 3 to 100 eV. The plasma is assumed to be tenuous and in the steady state. The power is assumed to be lost by radiation, ionization, and kinetic energy carried to the walls per second by the charged particles. The wall loss term used is calculated from sheath theory. The cost of producing a proton in various mixtures of neutral atomic and molecular hydrogen is also presented.
Author

N69-29932# Institut für Plasmaphysik G.m.b.H., Garching (West Germany).
REVIEW OF CURRENT SCIENTIFIC RESEARCH AT THE INSTITUT FUER PLASMAPHYSIK GMBH
Nov. 1967 29 p
Avail: CFSTI

A summary of research work currently conducted at the Garching Plasma Physics Institute, mentioning work on theta pinch problems, both linear and toroidal, high temperature plasmas, toroidal confinement, thermal alkali plasmas, propagation of ion cyclotron waves, microwave heating, ion beam-plasma interaction, wall problems, magnetoplasmadynamic generators, shock waves and plasma acceleration, laser produced plasmas, and theoretical investigations.
ESRO

N69-29933# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics.
MINIMUM TEMPERATURE AND POWER INPUT OF A FULLY IONIZED DENSE PLASMA
B. Lehnert, J. Bergström, and S. Holmberg Mar. 1969 5 p refs Sponsored by Swed. Atomic Res. Council
(Rept-69-04) Avail: CFSTI

Fully ionized high-density plasmas can be embedded in a neutral gas blanket but there are small power losses, due to neutral gas interaction, which are important when only limited power resources are available. Since the ionization rate drops with temperature it has a minimum value below which a fully ionized stationary plasma cannot be sustained. Calculations and experiments on minimum power levels using a rotating plasma and the high frequency heating of a static plasma are described.
ESRO

N69-29972# Royal Inst. of Tech., Stockholm (Sweden). Div. of Plasma Physics.
MICROWAVE INTERFEROMETRIC STUDIES OF A PLASMA BOUNDARY
N. I. Vinogradov and E. Tennfors Apr. 1969 6 p refs
(Rept-69-07) Avail: CFSTI

Microwaves with frequencies lower than the plasma frequency are reflected at the boundary of a plasma. The phase shift of the reflected beam depends on the position of the boundary and on the electron density distribution in the boundary region and this report concerns the behavior of the boundary and its expansion due to the centrifugal force of a rotating plasma. An 8 mm microwave interferometer was used and the waves were strongly absorbed in a plasma with a density where the plasma frequency equalled the wave frequency. Measurements indicated that the boundary is at least macroscopically stable.
ESRO

N69-30120# Nagoya Univ. (Japan). Inst. of Plasma Physics.
INFLUENCE OF COLLISIONS ON THE ION-ACOUSTIC INSTABILITY IN A WEAKLY IONIZED PLASMA
M. Fujiwara, M. Raether, and M. Yamada Mar. 1969 18 p refs
(IPPJ-81) Avail: CFSTI

The influence of collisions on the onset and linear stage of the ion-acoustic instability in a dc-discharge in helium is studied experimentally. The threshold values of the drift velocity and frequency and the range of the unstable frequency spectrum are in good agreement with the values calculated from the dispersion relation based on the Vlasov equation with inclusion of ion-neutral collision. The intensity of charged particle density fluctuation has been measured over 4 orders of magnitude covering the range from thermal level to the fully developed instability.
Author

N69-30124# Stichting Voor Fundamenteel Onderzoek Der Materie, Jutphaas (Netherlands).
MAGNETOHYDRODYNAMIC STABILITY OF THE TOROIDAL SCREW PINCH
R. F. de Vries (Ph. D. Thesis - Utrecht Univ.) Mar. 1969 52 p refs Supported in part by EURATOM
(Rept-69-52) Avail: CFSTI

Experiments and the theory of a toroidal screw pinch are described. In such a device plasma is confined by a pulsed helical magnetic field, whose longitudinal and azimuthal components are applied simultaneously. In the region outside the plasma column a dilute plasma is present. During the build-up of the confining field, currents are induced in this pressureless plasma which cause the pitch of the magnetic field to be uniform in space and constant in time. Measurements show that this uniform-and-constant-pitch model is a much better representation of the experimental situation than the conventional model, where the outside region is vacuum. The observed equilibrium position of the plasma column is in good agreement with the prediction of an existing theory for toroidal screw pinch surrounded by a uniform-and-constant-pitch magnetic field.
Author

N69-30137# Bergen Univ. (Norway). Dept. of Applied Mathematics.
ON NON-LINEAR MAGNETO-HYDRODYNAMIC WAVE MOTION IN DISSIPATIVE MEDIA
Leiv Storesletten Sep. 1967 28 p refs
Avail: CFSTI

Nonlinear MHD waves in inhomogeneous media are studied. Taking into account dissipation, the method of characteristics is applied to analyze the wavefront velocity. A closer examination of the basic equations shows that they do not satisfy the mathematical conditions for applying the method of characteristics. An analysis of the linearized equations, using the normal mode method, proves that the results are correct only for some specific values of the diffusion coefficients. For these specific values, the basic equations satisfy the mathematical conditions, and the method is applicable. Author

N69-30140# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
MAINTENANCE OF THE RESONANCE IN A CAVITY FILLED WITH A VARIABLE DENSITY PLASMA [ENTRETIEN DE LA RESONANCE D'UNE CAVITE CHARGEE PAR UN PLASMA DE DENSITE VARIABLE]
Gérard Melin (Ph.D. Thesis--Paris Univ., 28 Jun. 1968) Mar. 1969 97 p refs In FRENCH; ENGLISH summary
(CEA-R-3677) Avail: CFSTI

A study has been made of the possibility of maintaining in resonance a cavity filled with a plasma of variable density; only the low HF power zone has been examined (less than a few dozen W). A calculation is first made, for the chosen experimental conditions, of the shift of the resonance frequency of a cavity as a function of the plasma parameters (density, temperature). A description is then given of the equipment, including the S band cavity (3000 Mc/sec) supplied by a carcinotron type generator. Use is made of the plasma of a positive column whose density ($\simeq 10^{11}$ cm^{-3}) can easily be controlled so as to obtain shifts of the cavity frequency ($\Delta F_{max} \simeq 50$ Mc/sec). The zone of automatic agreement thus obtained for the S band is 3 per cent continuously ($\simeq 100$ Mc/sec) and 1 per cent ($\simeq 30$ Mc/sec) with a response time of 10μsec (sudden changes in density, $\Delta n \simeq 5 \times 10^{10} cm^{-3}$). These characteristics compare very favorably with existing systems, and can easily be improved. Author (ESRO)

N69-30151# Boeing Scientific Research Labs., Seattle, Wash. Plasma Physics Lab.
PLASMA PHYSICS LABORATORY REVIEW, 1968
1968 40 p refs
Avail: Issuing Activity

Results of continuing experimental and theoretical research are reported. Significant progress was made in theoretical determination of high frequency plasma waves among electrons in annulene ring molecules. Further development of the theory showed that these waves modify the interaction of individual electrons and hence their bound-state energy levels. Studies were conducted on the basic properties of electrically and optically injected plasmas in semiconductors, avalanche plasma instability, the pinch effect, and microwave radiation. As related to the theory of transport processes, two independent calculations were made to determine the electric current carried by a semiconductor in response to applied fields. Other topics for research included interferometric seismometry and investigation of the behavior of laser plasmas and laser-produced blast waves. A.C.R.

N69-30154# Institut fuer Plasmaphysik G.m.b.H., Garching (West Germany).
ANNUAL REPORT 1967 OF THE INSTITUTE OF PLASMA PHYSICS, MUNICH-GARCHING [JAHRESBERICHT 1967 DES INSTITUTES FUER PLASMAPHYSIK GMBH, MUENCHEN-GARCHING]
1968 189 p In GERMAN
Avail: CFSTI

The experimental and theoretical work of the Institute is described, dealing with theta pinch experiments to observe the ion density distribution, studies of plasma behavior in complex magnetic field arrangements, the interaction of plasma with the containing walls, plasma-particle interactions, the stationary heating of plasmas in strong magnetic fields, and theoretical investigations of the extension of theory to nonlinear models and technological problems of high energy discharges. ESRO

N69-30171# Texas Univ., Austin. Electronics Research Center.
INVESTIGATIONS OF A STREAMING PLASMA IN AN AXIAL MAGNETIC FIELD Interim Report
Eddie H. Young, Jr. and William C. Duesterhoeft, Jr. 20 Aug. 1968 131 p refs
(Grant AF-AFOSR-67-766A)
(AD-685124; JSEP-TR-55; AFOSR-68-1878) Avail: CFSTI CSCL 20/9

The purpose of this report is to study both theoretically and experimentally the behavior of a pulsed plasma streaming in a longitudinal magnetic field. Author (TAB)

N69-30185# American Science and Engineering, Inc., Cambridge, Mass.
ON A METHOD OF SOLUTION OF A CLASS OF SINGULAR TWO-POINT BOUNDARY VALUE PROBLEMS, VOLUME 2 Final Report, 15 Oct. 1967--14 Jan. 1969
Yvain M. Trove 7 Feb. 1969 71 p refs
(Contract F19628-67-C-0057)
(AD-685205; ASE-2184-Vol-2; AFCRL-69-0085) Avail: CFSTI CSCL 12/1

A certain type of singular two-point boundary value problem is described which is encountered in the solution of the differential equations of several known models for a plane and steady shock in a plasma. The principles of a method of solution of this type of problem are exposed and its range of applicability is investigated with the help of a mathematical model of known solution which possesses all the peculiar features of the physical models under consideration. From the results of this investigation it is shown that the method may be applicable to a specific model in the case of a relatively cold and dense plasma. Author (TAB)

N69-30204# Stichting voor Fundamenteel Onderzoek der Materie Utrecht (Netherlands). Instituut voor Plasma-Fysica.
RADIAL OSCILLATIONS OF A MAGNETIZED PLASMA CYLINDER IN PRESSURE EQUILIBRIUM WITH A COLD GAS BLANKET
L. C. J. M. de Kock Dec. 1968 14 p refs Sponsored in part by Euratom
(Rept-68-49) Avail: CFSTI

A magnetized plasma cylinder in pressure equilibrium with a cold gas blanket oscillates radially with a series of eigenfrequencies starting in the 10 kHz region. It was shown that these low frequencies are not suited to excite magnetoacoustic oscillations, since the amplitude of oscillation is low in the plasma region. Only at certain high frequencies have modes of oscillation been found at which energy can be supplied to the plasma cylinder. Author

N69-30208# Nagoya Univ. (Japan). Inst. of Plasma Physics.
THE DENSITY FLUCTUATION AND TRANSPORT PROCESS IN A PLASMA
M. Fujiwara and K. Takayama Mar. 1968 17 p refs
(IPPJ-80) Avail: CFSTI

The relation between the fluctuation and the transport process is clarified in a quiescent plasma. The diffusion coefficient, determined from the spectrum of the density fluctuation received by a single Langmuir probe, is found to be in good agreement with the coefficient derived from the correlation measurement of the density fluctuation detected by two Langmuir probes located at different positions within the plasma. Author

N68-30227# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MEASUREMENT OF THE VELOCITY OF A HIGH TEMPERATURE GAS IN A BOUNDARY LAYER BY AN ELECTRON-OPTICAL METHOD

B. P. Mironov et al Nov. 1968 8 p refs Transl. into ENGLISH from Fiz. Goreniya Vzryva(Novosibirsk), v. 3, no. 2, 1967 p 312–314
(AD-684836; FTD-HT-23-968-68) Avail: CFSTI CSCL 20/9

A contactless determination was made of the velocity field in a gas by suspending minute particles in the gas flow and measuring the particle velocities optically. The procedure is used in the present investigation to measure the distribution of the velocities in a high temperature gas emerging from a cylindrical tube. The gas was hot air from plasmatrons and the tube was water cooled. In the cold air the particles were illuminated with a 500-watt lamp; in the hot air, the particles (aluminum) burned and produced clearly visible tracks. The light from the particles was measured with a photomultiplier and recorded with an oscilloscope. The various errors involved in the apparatus and their sources are discussed briefly. The points obtained in the high temperature current in the turbulent core of the boundary layer practically agree with the isothermal values. The results become difficult to interpret in the immediate vicinity of the wall and further improvement in the procedure (decrease in the size of the particles, increase in the sensitivity) will be needed to improve the method. Author (TAB)

N68-30276# Deutsche Versuchsanstalt fur Luft- und Raumfahrt, Stuttgard (West Germany). Institut fuer Energiewandlung und Elektrische Antriebe.

INVESTIGATIONS ON PLASMA SOURCES FOR HALL ION ACCELERATORS [UNTERSUCHUNGEN AN PLASMAQUELLEN FUER HALLIONENBESCHLEUNIGER]

E. Zeyfang Nov. 1968 42 p refs In GERMAN; ENGLISH summary
(DLR-FB-69-23; DVL-854) Avail: CFSTI

Studies on plasma sources, particularly measurements of the current–voltage characteristics and of the rate of ion generation, have been carried out. A high current glow discharge with a heated cathode is used for ionizing the gas (argon). Depending on the temperature of the cathode the discharge can be sustained for two different modes: (1) For the low voltage mode, the applied potential is between 40 and 70 volts. The rates of ionization in the plasma beam are very low (<5%) while the effective ionization energy is high (> 1000 eV/ion). (2) For the high voltage mode, the applied potential is between 150 and 400 volts. This discharge type yields high ionization rates up to 55% and low effective ionization energies of about 300 eV/ion. Author

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N68-29097# Harvard Univ., Cambridge, Mass. Gordon McKay Lab.

PHYSICS OF FERROMAGNETIC AND FERROELECTRIC MEDIA Final Report, 1 Jan. 1964–31 Dec. 1967

R. V. Jones Oct. 1968 49 p refs
(Contract AF 19(628)-3874)
(AD-680618; AFCRL-68-0514; SR-12) Avail: CFSTI CSCL 20/12

The report reviews the research performed under the contract during the period 1 January 1964 to 31 December 1967. Topics discussed include the following: magnetic relaxation in insulators; physics of magnetic metals magnetic relaxation; band structure, and rare earth metals; magnetoelastic interactions; crystal growing facility; analysis of magnetic structures, microscopic models of magnetic interactions; ferroelectricity (microscopic interactions), and domain phenomena; magnetic alignment of interstellar grains; and a proposed electrooptical display device. TAB

N68-29368# Technische Hochschule Hannover (West Germany). Fakultaet fuer Mathematik und Naturwissenschaften.

ELECTRICAL AND X-RAY MEASUREMENTS OF SLOWLY DIFFUSING ELEMENTS IN SINGLE-CRYSTAL GERMANIUM [UNTERSUCHUNG DER DIFFUSION LANGSAM DIFFUNDIERENDER ELEMENTE IN EINKRISTALLINEM GERMANIUM MIT HILFE ELEKTRISCHER UND ROENTGENOGRAPHISCHER MESSUNGEN]

Adelbert Zielasek (Ph.D. Thesis) 1968 103 p refs In GERMAN
Avail: CFSTI

Single-crystal Ge layers doped by diffusion at 850° C with elements of the groups 3A and 5A of the periodic table were measured. The concentration profiles of the diffusing layers were determined by four-probe conductivity measurements on the layers. The diffusion of Sb was found to agree with the values for concentration distribution calculated by other investigators, while the diffusion of Al, Ga, and In appears to follow Fick's second law. Strong deviations from theoretical concentration values were noted in the diffusion of P and As. The diffusion coefficients of As, Sb, Bi, In, P, Ga, and Tl were determined and compared with available data. A radiographic method using the two-crystal arrangement is described which permits the determination of small changes in the lattice constant with an accuracy $\pm 7 \times 10^{-6}$ Å for single measurements. It is tentatively concluded that the vacancy mechanism is responsible for the diffusion of these elements in single-crystal Ge; it follows that the speed of diffusion is a function of lattice deformation. Transl. by K.W.

N68-29395 Johns Hopkins Univ., Baltimore, Md.

THE PLASTIC DEFORMATION OF CRYSTALLINE AGGREGATES

Thomas Henry Dawson (Ph.D. Thesis) 1968 72 p
Avail: Univ. Microfilms: HC $4.00/Microfilm $3.00 Order No. 68-16409

The plastic deformation of an aggregate of face-centered cubic crystals is examined theoretically, using the assumption that the individual grains deform by the simple shearing of material along certain crystal planes and directions. Continuity and equilibrium demands of the aggregate are met by assuming that each grain takes up the average stress and deformation of the entire aggregate. These assumptions, together with angular equilibrium requirements, are than shown to place severe restrictions on the crystallographic rotations of the grains which were not taken into account in previous theories proposed by Taylor and Bishop and Hill. Upper-bound yield strengths are calculated for the case of a hollow tube subjected to both direct and combined tension and torsion loadings, and these are found to be generally about ten percent greater than corresponding experimental measurements. Dissert. Abstr.

N69-29407*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADHESION OF GOLD TO VARIOUS PLANES OF COPPER STUDIED WITH LEED
Donald H. Buckley Washington Jun. 1969 20 p refs
(NASA-TN-D-5290) Avail: CFSTI CSCL 20L

An investigation was conducted with the aid of LEED, to determine the influence of crystallographic orientation on adhesion of gold to copper. A single gold orientation contacted three planes of copper, the (111), (100), and (110) planes. Adhesion under light loads resulted in adherence of gold to all three planes of copper. This result could be correlated with theoretical considerations of adhesive and cohesive bonding forces. The gold bonded epitaxially to all three planes of copper, with the weakest force of adhesion occurring to the (111) plane of copper. While lattice strains were observed to occur in gold as a result of such adhesive contacts, no such strain was noted in the copper. Author

N69-29540# University Coll. of North Wales, Bangor. Dept. of Physics.
INVESTIGATION OF MATERIALS SUITABLE FOR THE FABRICATION OF SPACE CHARGE AMPLIFIERS Final Technical Report, Oct. 1967–Sep. 1968
R. H. Tredgold Sep. 1968 15 p
(Contract DAJA37-68-C-0137)
(AD-684965) Avail: CFSTI CSCL 20/12

The report describes attempts to produce epitaxial films of boron phosphide (BP) and the difficulties encountered involving decomposing films and substrate etching. A successful method of producing large quantities of amorphous BP powder is presented and methods for single crystal growth using this powder as a starting material are described. Various modifications and refinements on current apparatus are described and new methods to be attempted are discussed. Author (TAB)

N69-29544# IIT Research Inst., Chicago, Ill.
THE THERMAL CONDUCTIVITY OF GAMMA-IRRADIATED KCl CRYSTALS BETWEEN 0.4 AND 4°K
Raymond A. Guenther (Ph.D. Thesis) Jan. 1969 113 p refs
(Contract AT(11-1)-1629)
(COO-1629-11) Avail: CFSTI

Thermal conductivity measurements between 0.4 and 4°K were undertaken to test a defect model proposed by Sonder and associates. This model postulates the formation of interstitial chlorine (formed in conjunction with trapped electron centers) and that these interstitials aggregate to form clusters (colloids)–the size of and number of which depend on the irradiation temperature and impurities in the crystal. Using the low-temperature thermal conductivity as a means of detecting and gaging the size of clusters, it was found that for two samples irradiated at room temperature, there were aggregates of an effective radius of 70 Å. A sample irradiated at liquid-nitrogen° temperature, and warmed to room temperature before the thermal conductivity was measured, showed no evidence of colloids for the radiation dose available. Author (NSA)

N69-29588*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
RANDOM PHASE APPROXIMATION FOR THE ANISOTROPIC HEISENBERG FERROMAGNET
Lawrence Flax and John C. Raich (Colo. State Univ.) Washington Jun. 1969 21 p refs
(NASA-TN-D-5288) Avail: CFSTI CSCL 20L

The theory of anisotropic Heisenberg ferromagnets is developed in the random phase and spin wave approximation. It is shown that thermodynamic quantities such as magnetization can be expressed in analytic form for all temperatures. To demonstrate the applicability of this technique the magnetization for body-centered, face-centered, and simple-cubic lattices was calculated. Author

N69-29724*# Research Triangle Inst., Durham, N.C.
A FEASIBILITY STUDY OF A MINIATURE SOLID-STATE PRESSURE TRANSDUCER
C. D. Parker Washington NASA Jul. 1968 67 p refs
(Contract NAS1-7489)
(NASA-CR-1366) Avail: CFSTI CSCL 14B

The piezojunction effect, i.e., the sensitivity of the electrical characteristics of a p–n junction to mechanical strain, is summarized and its potential as a stress transducing mechanism discussed. Several configurations are described which provide for using the piezojunction effect as the sensory phenomenon in a pressure transducer, including a unique silicon needle sensor with a p–n junction in the needle apex. Needle sensors with excellent electrical characteristics were fabricated and demonstrated to be extremely sensitive to stress. These were fabricated into pressure transducers which detected pressure differentials of less than 100 μHg. Author

N69-29854# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE INTERPRETATION OF DIFFRACTION PICTURES OF SLOW ELECTRONS ON NaCl
G. K. Zyryanov 25 Oct. 1968 13 p refs Transl. into ENGLISH from Vestn. Leningr. Univ., Ser. Fiz. i Khim. (Leningrad), no. 3, 1966 p 70–74
(AD-685543; FTD-MT-24-357-68) Avail: CFSTI CSCL 20/2

A shift in electron reflections was noted with change of electron wave length in diffraction expts. normal to the (100) surface of NaCl crystals. The reflections observed were correlated to NaCl reciprocal lattice points, assuming vol. scattering. Author (TAB)

N69-29926# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DISPERSION CORRECTION IN THE DEBYE THEORY OF HEAT CAPACITY OF A SOLID
N. S. Adkhamova 11 Oct. 1968 10 p refs Transl. into ENGLISH from Dokl. Akad. Nauk Tadzh. SSR (Stalinabad), v. 9, no. 1, 1966 p 13–17
(AD-685478; FTD-HT-23-957-68) Avail: CFSTI CSCL 20/12

Equations are developed which recognize the inelasticity of the longitudinal and transverse vibrations in the lattice. The resultant expression for the characteristic temp. theta is considerably more complex than the simple Debye expression, and comprises temperature-dependent terms. Such terms are necessary to account for temperature-dependence of the characteristic temp. previously observed for a number of metals including W for which a minimum is observed. TAB

N69-29828*# Battelle Memorial Inst., Columbus, Ohio.
PERFECTION OF MATERIALS TECHNOLOGY FOR PRODUCING IMPROVED GUNN-EFFECT DEVICES
A. C. Beer, R. D. Baxter, J. W. Moody, J. E. Bennett, and J. F. Miller 30 Sep. 1968 23 p refs
(Contract NAS12-632)
(NASA-CR-86152) Avail: CFSTI CSCL 20L

A chemical vapor deposition system was developed, which is capable of providing low-carrier density high-mobility GaAs epitaxial layers by the $AsCl_3$ method. The results of investigations carried out to determine sources of acceptor centers were incorporated into the design. Noteworthy of these was a special

hydrogen purifier unit and use of Spectrosil in the reactor. Analyses of resulting specimens revealed electron concentrations from 10^{14} to 10^{18} cm^{-3}, depending on the lot of $AsCl_3$ used, with mobilities at 300°K approaching 6000 cm^2/v-sec. Initial success was achieved in growing both GaAs and GaSb by solution epitaxy although a significant degree of surface roughness was noted. In the case of GaSb, the solution growth technique permitted the use of highly antimony-rich melts which are desirable for reduction of the antistructure defect concentrations. Author

N69-29952# California Univ., San Diego. Dept. of Physics.
TOMONAGA'S MODEL AND THE THRESHOLD SINGULARITY OF X-RAY SPECTRA OF METALS
K. D. Schotte and U. Schotte Apr. 1969 14 p refs
(Contract Nonr-2216(11))
(AD-685525; TR-58) Avail: CFSTI CSCL 20/12

Singularities near the threshold of the soft X-ray spectra of metals have been predicted by G. D. Mahan and have recently been calculated by Nozieres et.al. using the model of a localized core hole. It is shown that the singular behavior can be understood in terms of density waves of the conduction electrons which are excited when, in the absorption process, the core hole is created providing an attractive potential for the conduction electrons. For the description of the conduction electrons in terms of density waves, Tomonagas model is adopted. Author (TAB)

N69-29958# Hebrew Univ., Jerusalem (Israel). Dept. of Physics.
CRYSTAL CHEMISTRY AND GROWTH OF LOW MAGNETIC ANISOTROPY CRYSTALS Final Scientific Report, 1 Nov. 1966–31 Oct. 1968
Michael Schieber Nov. 1968 38 p refs
(Contract F61052-67-C-0038)
(AD-685214; AFCRL-69-0104) Avail: CFSTI CSCL 20/2

A method to grow mixed cation substituted yttrium iron garnets (YIG) where the cations are calcium and silicon is described. Special flux solvent is used, based on lead oxide and is free of fluorine. Crystals of the composition (Y(3)-x-y)Ca(x)Bi(y)) (Fe2) (Fe(3-x)) O12 with x varying from 0.4 to 1.2 and y from 0.01 to 0.5 are produced. Some of the crystals could be prepared to contain Mo(6+) up to Z = 0.05. The crystals have a much lower saturation magnetization than YIG depending on the value of x. The microwave resonance absorption has a linewidth in the order of about 30 oersteds. The Curie temperature of the crystals are relatively high and even for x = 1.2 it is above 200C. Single crystals with a composition Yb3 Fe(5-x) Ga(x)O12 with x varying from 0.5 to 4.0 were grown from a PbO-PbF2 flux and the growth conditions were compared. Polycrystalline Cd Cr2S4 material was prepared by two different methods doped with Fe57. Polycrystalline Mo(6+), Ca(2+) and Si(4+) substituted YIG compounds have been prepared and the crystallographic unit cell reported. Author (TAB)

N69-29960# Cornell Univ., Ithaca, N.Y. Materials Science Center.
BRILLOUIN SCATTERING IN PURE AND MIXED CUBIC CRYSTALS
Ferdinand Nicholas Cirillo, Jr. (Ph.D. Thesis) Jan. 1969 154 p refs
(Contract Nonr-401(47))
(AD-685288; Rept-1086; TR-27) Avail: CFSTI CSCL 20/2

The room temperature Brillouin spectrum of RBI, KBr, KCl, and KBr:KCl cubic crystals has been investigated by measurements on the fine structure satellites of Helium-Neon laser light of 6328 A scattered by these crystals. Spectroscopic measurements with a pressure scanned Fabry-Perot interferometer and a photomultiplier were made of the light scattered by the transverse, longitudinal, and mixed modes of sound waves propagating in the (100) plane. From the shifts in the frequency of the incident light, values of the velocity of sound and the elastic constants c11, c12, and c44 were determined for each crystal. The results are in good agreement with those obtained by classical acoustic techniques. Author (TAB)

N69-30009# Norwegian Inst. of Tech., Trondheim. Electronics Research Lab.
SCATTERING OF LIGHT BY ULTRASONIC SURFACE WAVES IN CRYSTALS
J. Krokstad (Institutt for Teoretisk Elektroteknikk) Oct. 1967 75 p refs
(TE-93) Avail: CFSTI

Two methods of investigating the properties of ultrasonic surface waves in crystals by means of light are presented. In the first method the light reflected from the deformed surface of the crystal is considered. For simplicity the surface is assumed to be perfectly conducting. Theoretical expressions for the scattered light are given. In the second method the plane wave approximation of Raman and Nath is adopted to the special case of surface waves. The relative light intensity distribution is calculated for the different diffraction orders. Experiments on scattering by ultrasonic surface waves in quartz are reported. Author

N69-30017*# Aztec School of Languages, Maynard, Mass. Research Translation Div.
THEORY OF ELECTROMAGNETIC WAVES IN METALS AND THEIR INTERACTION WITH ULTRASONIC WAVES [THEORIE ELECTROMAGNETISCHER WELLEN IN METALLEN UND IHRER WECHSELWIRKUNG MIT ULTRASCHALLWELLEN (1)]
J. Mertsching Washington NASA Jun. 1969 75 p refs Transl. into ENGLISH from Phys. Status Solidi (West Ger.), v. 14, no. 1, 1966 p 3–61
(Contract NASw-1892)
(NASA-TT-F-12114) Avail: CFSTI CSCL 20L

Theoretical principles are developed and resonance effects of waves in an extended magnetic field are discussed as applied to determine the Fermi surface of metals. The dispersion equation and the surface impedance are derived for electromagnetic waves. Both are materially dependent upon the dynamic conductivity tensor or the conduction electrons in a magnetic field. The discussion is limited to the frequency range of microwaves and ultrasonic waves and to the electron behavior in the immediate region of the Fermi surface. Coupled dynamical equations are then derived for the lattice ions and the electromagnetic field, from which the dispersion equation for coupled ultrasonic and electromagnetic waves follows. A tensor description, which includes the Green function of the Boltzmann equation, is given for the physical dimensions of the resonance phenomena. The two resonance dimensions which appear in the Green function, the exponential factor which causes so-called geometric resonance as well as the hyperbolic co-tangent which describes the so-called cyclotron resonance; and the quantum oscillations of the factor Q, analogous to the de Haas van Alphen effect are considered and discussed for a single cyclotron path and then for the cooperation of the various resonances of all cyclotron paths which leads to the observable total resonance. B.P.

N69-30032# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE HALL EFFECT IN SAMPLES OF A ROUND CONFIGURATION
V. L. Konkov 2 Jul. 1968 7 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Fiz. (Tomsk), no. 2, 1966 p 159–160
(AD-685163; FTD-HT-23-249-68) Avail: CFSTI CSCL 20/12

In view of the fact that most Hall-constant measurements are made with rectangular-section samples, whereas semiconductor

properties are usually investigated with round samples, the author determines theoretically the field potential necessary to measure the Hall emf in round samples. The differential equation for the potential is derived and is solved under the assumption that the magnetic field is weak. The solution shows that the expression for the Hall emf is the same as in the case of rectangular samples, so that if a round sample is used and the current and Hall electrodes are secured to the ends of mutually perpendicular diameters, the results will be the same as for a rectangular section. Author (TAB)

N69-30035*# North American Rockwell Corp., Anaheim, Calif. Autonetics Div.

INVESTIGATION OF SINGLE-CRYSTAL FERRITE THIN FILM

P. J. Besser, J. E. Mee, and E. C. Whitcomb Jun. 1969 38 p refs

(Contract NAS12-522)

(NASA-CR-86157) Avail: CFSTI CSCL 20B

Continuous research on the growth and characteristics of single crystal thin films of lithium ferrite ($LiFe_5O_8$) has resulted in changes of deposition conditions that have produced smoother films, an expanded deposition zone, increased growth rates, and deposits with magnetic moments close to that of $LiFe_5O_8$. The deposits have been characterized by chemical, X-ray, electrical, optical, and magnetic techniques. A description of the experimental approach is presented, in which the substrates used are defined as magnesium oxide crystals and the source materials as lithium iodide and iron chloride. Also noted is a change over previous methods in the preparation of the substrates which are chemically polished for five minutes in a phosphoric acid solution heated to 300°C, for one and one half hours and then cooled to the 270°C etching temperature. Analytical procedures for the chemical analysis of lithium ferrite thin films are discussed, and characterization data obtained by the techniques previously mentioned are presented. D.L.G.

N69-30072*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

GROWTH OF 2-H SILICON CARBIDE CRYSTALS

J. Anthony Powell Washington Jul. 1969 15 p refs

(NASA-TN-D-5313) Avail: CFSTI CSCL 20B

Crystals of one of the rarer crystalline modifications of silicon, 2H SiC, were grown. These crystals with dimensions up to 3.3 mm in the c-direction and 0.3 mm in the a-directions were usually transparent and either colorless or amber colored. Growth was by the reduction of methyltrichlorosilane (CH_3SiCl_3) in a H_2 atmosphere in the temperature range 1300° to 1400°C. The vapor-liquid-solid (VLS) mechanism, which has been suggested for previous 2H SiC growth, was not involved in this growth. Factors affecting the crystal growth were the susceptor temperature profile and the CH_3SiCl_3 concentration in H_2. Author

N69-30083*# New York Univ., N.Y. School of Engineering and Science.

PRECURSOR IONIZATION EFFECTS ON MAGNETOHYDRODYNAMIC SWITCH-ON SHOCK STRUCTURE

Martin I. Hoffert Mar. 1969 38 p refs

(Grant NGR-33-016-067)

(NASA-CR-101680; F-69-3) Avail: CFSTI CSCL 20L

The influence of shock-induced precursor ionization on the steady-state structure of switch-on shock waves with nonequilibrium ionization and radiation is examined theoretically. A single-temperature monatomic gas is assumed, together with a Clarke–Ferrari model for photoionization of the upstream gas. It is found that the effect of the precursor depends in general on the ratio of a characteristic precursor length to a characteristic magnetic interaction length. For the slightly ionized case treated in some detail, this ratio is much greater than unity, indicating a precursor-independence for the magnetohydrodynamic shock structure. Author

N69-30121# Technische Hogeschool, Eindhoven (Netherlands).

FLUX MOTION AND NOISE IN SUPERCONDUCTORS

Gerardus Josephus van Gurp (Ph.D. Thesis) 1969 120 p refs

Avail: CFSTI

The presence of magnetic flux in superconductors is investigated. Since a magnetic flux through a surface is defined as the surface integral of the magnetic induction B, this report deals with the values of B in superconductors. In a homogeneous superconductor the magnetic induction in zero magnetic field is zero. As regards the response to the application of a magnetic field H, superconductors are divided into two types, type 1 and type 2 superconductors. A brief description of these two types are given. Since this document deals with the occurrence of a noise voltage due to variations of the local values of B in superconductors, an historical review of noise measurements on superconductors is included. Author

N69-30167*# National Bureau of Standards, Washington, D.C. Electronic Technology Div.

METHODS OF MEASUREMENT FOR SEMICONDUCTOR MATERIALS, PROCESS CONTROL, AND DEVICES Quarterly Report, 1 Jan. - 31 Mar. 1969

W. Murray Bullis ed. Jul. 1969 45 p refs Supported in part by NASA, DASA, and the Navy

(NASA-CR-101692; NBS-TN-488) Avail: SOD $0.50; CFSTI CSCL 20L

Principal emphasis was placed on measurement of resistivity, carrier lifetime, and electrical inhomogeneities in semiconducting crystals; evaluation of wire bonds; and measurement of thermal properties of semiconductor devices. Other tasks involved: study of infrared measurement methods, deep-lying impurities in InSb, gold in silicon, and high field effects; establishment of a processing facility; evaluation of aluminum metallization and wafer die attachment; review of NASA measurement methods; and measurement of Hall effect in semiconductor crystals, second breakdown in transistors, and noise in microwave diodes. Related projects on silicon nuclear radiation detectors and specification of germanium are also described. Author

N69-30374# Technische Hogeschool, Eindhoven (Netherlands).

STUDY OF GROWTH AND DEFORMATION FAULTS IN CRISTOBALITE [ONDERZOEK NAAR GROEI- EN DEFORMATIEFOUTEN IN CRISTOBALIET]

A. A. W. A. van Eulem (Ph.D. Thesis) 1969 200 p refs In DUTCH; ENGLISH summary

Avail: CFSTI

According to the literature, many physical properties of cristobalite vary strongly with the conditions under which this SiO_2-phase has been formed. In this thesis, mathematical expressions are derived which describe the effects of stacking faults on the X-ray powder pattern of the low temperature modification of cristobalite. The X-ray powder pattern method has been previously used for the interpretation of diffraction patterns of cold worked metals. The faults were assumed to originate both during the crystal growth and as a result of lattice deformation. Relations are derived which correlate the growth and deformation fault concentration quantitatively with parameters describing the shape of an X-ray diffraction line profile. Author

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N69-29077# California Univ., Livermore. Lawrence Radiation Lab.
VELOCITIES OF FRAGMENTS FROM EXPLODING METAL CYLINDERS
Edward L. Lee and Harold Pfeifer 6 Jan. 1969 6 p refs Sponsored by AEC
(UCRL-50545) Avail: CFSTI

Calculations with one- and two-dimensional hydrodynamic codes were made to compare the results of end-surface and axial initiation of high explosives in cylindrical metal tubes. The comparison shows that for long tubes, the terminal fragment velocities resulting from the two modes of initiation are nearly identical. The important differences are found at HE length-to-diameter (L/D) ratios of less than 3, where the metal velocities calculated for axially initiated cylinders are significantly larger. Author (NSA)

N69-29284*# Pratt and Whitney Aircraft, West Palm Beach, Fla. Research and Development Center.
INVESTIGATION OF LIGHT HYDROCARBON FUELS WITH FLOX MIXTURES AS LIQUID ROCKET PROPELLANTS
Final Report
1 Sep. 1965 295 p refs
(Contract NAS3-4195)
(NASA-CR-54445; PWA-FR-1443) Avail: CFSTI CSCL 21I

An analysis was completed for determination of the most promising hydrocarbon fuels for use with flox in upper stage rocket engines. Experimental rocket firings in uncooled, transpiration cooled, and regeneratively cooled thrust chambers were conducted using flox with methane, propane, butene-1, and a eutectic blend of pentane and isopentane. Experimentally heated tube, heat transfer and hypergolicity tests were conducted, and laboratory determinations of physical properties of various blends of hydrocarbon compounds were made. Author

N69-29744# North Carolina State Univ., Raleigh.
EXPERIMENTAL METHOD FOR DIFFRACTION STUDIES DURING IMPACT
R. A. Douglas, W. L. Bingham, H. W. Blake, and W. L. Liddell Feb. 1969 48 p refs
(Contract N00014-68-A-0187; ARPA Order 1090)
(AD-685243; TR-69-1) Avail: CFSTI CSCL 19/1

A new experimental system and method has been developed to determine the large axial strains, strain-rates, and the wave velocities associated with individual strain levels during axial impact at velocities to several thousand feet per second. The system employs in-surface diffraction grating strain transducers illuminated by a pulsed ruby laser, with the time-dependent diffraction pattern recorded by a high speed streak camera. Author (TAB)

N69-29857# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
DETONATION OF LIQUID EXPLOSIVE MIXTURES AT LOW TEMPERATURES
V. A. Letyagin and V. S. Solovev Dec. 1968 12 p refs Transl. into ENGLISH from Fiz. Goreniya i Vzryva (USSR), v. 3, no. 3, 1967 p 393–397
(AD-685014; FTD-HT-23-1038-68) Avail: CFSTI CSCL 21/8

The detonability of mixtures of liquid fuel and oxidizer at low temperatures has been studied for two cases: (1) both oxidizer and fuel are in the solid state; (2) the oxidizer is in the solid state and the fuel in the liquid state. The following mixtures were used: tetranitromethane (TNM)-gasoline, TNM-nitrobenzene, and TNM-benzene (all 70/30 by volume). It is noted that one of the important factors is the oxidizer grain size, the grain of liquid-particle size of the fuel, and their mutual arrangement. The detonability of liquid explosives in the case of rapid cooling which gives rise to a finely divided charge structure with a grain size of 5–10 micron was studied in greatest detail. In this case, the mixture is molecular prior to cooling and mechanical after cooling. In addition, rapid cooling gives rise on crystallization to nitrogen tetroxide bubbles which form additional pores in the charge and may affect the development and initiation of the detonation. Author (TAB)

N69-29919# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ENERGY SOURCES IN AIRCRAFT ENGINES
Pin-Chuan Chang 9 Oct. 1968 7 p Transl. into ENGLISH from Hang Kung Chih Shih (China), no. 7, 1960 p 16
(AD-685535; FTD-HT-23-584-68) Avail: CFSTI CSCL 1/3

After reviewing the properties and limitations of chemical fuels such as gasoline, solid fuel and hydrogen fuel, the report discusses the possibilities of ionic fuel and nuclear fuel, and their existing problems of application to aviation. It is stressed that due to the fast scientific progress and requirements, these pending problems may soon be solved. Author (TAB)

N69-29966*# Aerojet-General Corp., Sacramento, Calif. Propellant Research and Development Div.
THE EFFECT OF SOLID PHASE REACTIONS ON THE BALLISTIC PROPERTIES OF PROPELLANTS
Willfred G. Schmidt May 1969 54 p refs
(Contract NAS1-7816)
(NASA-CR-66757) Avail: CFSTI CSCL 21I

The decomposition of NH_4ClO_4 and methyl substituted ammonium perchlorate systems have been studied under both isothermal and non-isothermal conditions. Both conventionally mixed and pressed powder composite strands were used in making burning rate determinations. The experimental approach was essentially a chemical one and the decomposition of NH_4ClO_4 (and methyl substituted ammonium perchlorate) was both accelerated and decelerated by additives and environmental conditions. The results were used to identify the NH_4ClO_4 decomposition mechanisms which appear to be important under combustion conditions. A hypothesis is offered to explain how the ignition and decomposition of NH_4ClO_4 affects the burning rate of an NH_4ClO_4 composite propellant. Author

N69-30203# Bureau of Mines, Bartlesville, Okla. Petroleum Research Center.
STORAGE STABILITY OF HIGH TEMPERATURE FUELS. PART 2. THE EFFECT OF STORAGE UPON THERMALLY INDUCED DEPOSITION OF LABELED FUEL COMPONENTS Annual Report, Mar. 1968–Mar. 1969
M. L. Whisman and C. C. Ward Mar. 1969 127 p refs
(Contract F33615-67-M-5003)
(AD-685201; AFAPL-TR-68-32-PT-2) Avail: CFSTI CSCL 21/4

This investigation is concerned with the contribution of selected components and additives of high-temperature aircraft fuels to thermally induced deposits before and after 52 weeks storage at 130F. Of particular concern is the influence of these fuel constituents on thermal-stability quality of these jet fuels during storage. The study utilizes a micro fuel coker test apparatus to measure the thermal-stability of test fuels and blends. The contribution of selected fuel components, labeled with carbon-14, to deposit-forming mechanisms is determined by radioactive counting techniques. Author (TAB)

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magneto-hydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N69-29036# Weaver Associates, Inc., Palo Alto, Calif.
SOLID PROPELLANT ROCKET AUTOMATIC THRUST TERMINATOR Development Summary Report
Aug. 1968 82 p
(AD-680500; WA-1045) Avail: Issuing Activity CSCL 21/8.2

The descriptions and summary presented in this report are intended to provide a general understanding of the capabilities and principal features of solid propellant rocket automatic thrust terminators designed to utilize motor case expansion both to derive energy from and to sense motor ignition. The devices are intended for use during those stages of logistic cycles wherein accidential ignition could result from accident or mishandling. They are designed to minimize the damage potential of such an event by causing total destruction of the motor before full thrust can be attained. TAB

N69-29128*# National Aeronautics and Space Administration, Washington, D.C.
JET PROPULSION INSTITUTE
H. Kuehl and H. Barth Jun. 1969 24 p Transl. into ENGLISH from the German Report
(NASA-TT-F-12209) Avail: CFSTI CSCL 21E

A summary is presented of activities carried out at the Jet Propulsion Institute of the German Research Institute for Aeronautics and Astronautics during 1967. The summary deals with administrative changes, research on combustion and flow, flames, their stabilization and quenching, reaction kinetics, as well as several elementary reaction mechanisms. Author

N69-29142*# Techtran Corp., Glen Burnie, Md.
EXPERIMENTAL STUDIES ON THE PRIMARY ZONE OF HIGH-INTENSITY COMBUSTORS
T. Otsuka, K. Suzuki, A. Ishii, and T. Hirose Washington NASA Jun. 1969 99 p refs Transl. into ENGLISH from the Japanese Report
(Contract NASw-1695)
(NASA-TT-F-11922; NAL-TR-143) Avail: CFSTI CSCL 21E

A series of experiments was carried out to investigate the characteristics of the primary combustion zone. To meet the requirements for a high intensity combustor, a large quantity of fuel should be supplied at a state of high air-loading of the combustor; however, generally speaking, an increase of the supplied fuel in such a case tends to deteriorate the combustion efficiency. This lower efficiency is connected not only with the increase of thermal loading, but also with the deficiency in holding a stable flame in the primary zone. The flow patterns and flame-holding characteristics behind the isolated swirlers under test were observed; and several tentative devices were applied to the model swirlers. Then a combined model with three swirlers was tested in order to examine the mutual interference between the swirlers, as well as the effects of the liner wall and the influence of air-holes of the liner on the swirler characteristics. Author

N69-29185# Boeing Co., Seattle, Wash. Office of International Operations.
SECONDARY FORCES ON A VTOL PLANE DURING HOVERING AND TRANSITION, TAKING ACCOUNT OF GROUND EFFECTS
G. Schulz et al Mar. 1969 29 p refs Transl. into ENGLISH from German Report No. DVL-851
(DVL-851; B-851; A-61) Avail: CFSTI

In a VTOL aircraft the engine jets passing by the individual airplane parts in close proximity affect the aerodynamic coefficients to a considerable degree. This effect is particularly strong close to the ground. An understanding of the processes unrolling is made more difficult by the numerous constructive and aerodynamic parameters. In particular, the mutual effects of single engines and coupling of jet and ground effect present a problem. These secondary engine jet effects are analyzed by means of extensive, systematic measurements made in a wind tunnel model with simulated engine jets. Author

N69-29300*# Aerojet-General Corp., Sacramento, Calif. Propulsion Div.
INJECTOR ORIFICE STUDY, APOLLO SERVICE PROPULSION SYSTEMS Summary Report, 7 Apr. 1967 – 31 Jul. 1968
15 Jul. 1968 15 p
(Contract NAS9-6925)
(NASA-CR-99684; Rept-6925-S) Avail: CFSTI CSCL 21H

The primary objective of the injector orifice study (IOS) was the development of an optimized injector design for advanced Apollo missions. To achieve this objective the program was organized to include an investigation into the characteristics of injector orifices. The knowledge gained from this investigation was then incorporated into the optimized injector design criteria. Phase I of the two-phase effort was conducted to evaluate injector hydraulic design parameters by means of a review of previous applicable work on short-tube flow, cold-flow testing of selected types of orifices, and establishing injector design criteria. The Phase II effort consisted of fabrication and test of the injector designed during Phase I. Author

N69-29331*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
STEADY-STATE STRESS RELAXATION ANALYSIS OF TURBINE BLADE COOLING DESIGNS

Albert Kaufman Washington Jun. 1969 47 p refs
(NASA-TN-D-5282) Avail: CFSTI CSCL 21H

An analytical evaluation was made of five turbine blade cooling configurations for advanced airbreathing engines on the basis of the time to a local creep strain of 1% for cast IN 100. The longest life was shown by the transpiration design followed by the multiple small hole design. Curves were established to predict the multiple small hole blade life under various combinations of turbine inlet and coolant temperatures and coolant to total gas flow ratios. Author

N69-29405*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
APPLICATION OF A DOUBLE-DEAD-TIME MODEL DESCRIBING CHUGGING TO LIQUID PROPELLANT ROCKET ENGINES HAVING MULTIELEMENT INJECTORS
John R. Szuch Washington Jul. 1969 40 p refs
(NASA-TN-D-5303) Avail: CFSTI CSCL 21H

Stability limits were determined experimentally for a 1.4-inch-(3.56-cm-) diameter rocket engine. Liquid oxygen and gaseous hydrogen were the propellants. A chamber pressure of 250 psia (172 N/cm^2) and a mixture ratio of 5.0 were maintained for contraction ratios of about 1.9 and 3.0. A seven-element injector was run with both concentric-tube and transpiration-cooled faceplate methods of fuel injection. Data were also obtained with a 421-element 10.8-inch diameter engine. For comparison with experimental data, stability boundaries were generated on the analog computer. Results indicated that accurate predictions of stability limits can be made using the double-dead-time model and existing vaporization and drop-size correlations. Large engine instabilities were prevented because of feed system coupling effects, as predicted by the analysis. Author

N69-29432# Boeing Co., Seattle, Wash.
WATER JET PROPULSIONS FOR HIGH-SPEED VEHICLES
C. Kruppa et al [Mar. 1969] 35 p refs Transl. into ENGLISH Presented at Shipbuilding Soc. Conf.
Avail: CFSTI

Continuously operating water jet propulsion and the state-of-the-art of its applicability to air cushion vehicles with rigid side walls as well as gliders and hydrofoils were reviewed. The propulsion system discussion emphasized accommodation by proper design of two extreme operating conditions, maximum speed and the critical speed. The power requirement for jet propulsion was defined as uniquely measurable, proven and illustrated through momentum and velocity calculations. The optimum velocity ratio, pump requirements, and scoop and nozzle geometry were discussed from the standpoint of optimal design configurations. Systemic test sequences for actual design products were outlined for maximum applicability to large scale optimized test versions. The cavitation number of the intake channel and its drag coefficient were demonstrated to be valid comparators of propulsive efficiency and reliability. M.H.E.

N69-29499*# Aerojet-General Corp., Sacramento. Propulsion Div.
INJECTOR SERVICE STUDY, APOLLO SERVICE PROPULSION SYSTEM Final Report, 7 Apr. 1967 – 31 Jul. 1968
31 Jul. 1968 233 p refs
(Contract NAS9-6925)
(NASA-CR-99686; Rept-6925F) Avail: CFSTI CSCL 21H

Both contoured and sharp-edged orifices were evaluated. Their primary differences occur in the stream contraction coefficient at the vena contracta as shown schematically. Furthermore, the sharp-edged orifice can exhibit either attached flow at a high static pressure recovery factor or with detached flow at negligible recovery. Each of these orifices in turn are affected by impingement angle, flow orientation angle, and cross velocity which affect their orifice entrance condition (vena contracta) and effective momentum due to cross velocity. The orifice affects the rate of static pressure recovery, frictional pressure loss, and flow reestablishment in asymmetrical flow. No readily identifiable effect attributed to back pressure except the suppression of cavitation and the occurrence of hydraulic flip. A conceptual schematic diagram of all the possible flow interaction effects and the ranges of test variables considered are included. Author

N69-29562# Naval Ship Research and Development Center, Annapolis, Md.
CONSTRUCTION AND OPERATION OF A HOT-CORROSION TEST FACILITY
Harvey von E. Doering and Paul A. Bergman Mar. 1969 32 p refs
(AD-684440; NSRDC-2844; MATLAB-281) Avail: CFSTI CSCL 21/5

An apparatus, the burner rig, used to evaluate materials for use in gas-turbine engines operating in a marine environment, is described. Testing procedures are outlined, and results are discussed in relation to gas-turbine engine tests. The rig operates by the combustion of diesel oil or jet fuels. Injected seawater and the products of combustion pass over as many as 48 test specimens. Although the rig operates at atmospheric pressure and low velocities, it can generate a test environment that results in hot corrosion as found in actual engines. Author (TAB)

N69-29642*# Nortronics, Huntsville, Ala.
PLUME CHARACTERISTICS OF THE SATURN CLUSTER MODEL
D. O. Barnett 23 Dec. 1968 32 p
(Contract NAS8-20082)
(NASA-CR-61283; M-79-8-472) Avail: CFSTI CSCL 21H

Results are presented on one phase of a program to determine acoustic and hydromechanical loads at the base of Saturn configured vehicles. Data are presented on pitot pressure distributions across clusters of one to four jets exhausting at stagnation-to-ambient pressure ratios of 35 to 105 atmospheres. The data are compared with results of a method of characteristics solution for the flow field. An empirical correlation is given for the growth of the shear region of the plumes near the nozzle exit plane. It is seen that shear layer thickness varies directly with axial location and inversely with stagnation pressure. Author

N69-29792# Boeing Co., Seattle, Wash. Office of International Operations.
AIR BREATHING BOOSTER PROPELLED BY A SUPERSONIC RAMJET
J. J. Blanc Jan. 1969 35 p refs Transl. into ENGLISH from French Presented at 5th Colloq. on Appl. Aerodynamics, Nov. 1968
(E-268) Avail: CFSTI

Within the framework of feasibility studies for breathing boosters, an investigation was made of the concept of a booster propelled by a supersonic ramjet. This presentation shows the performances and the limitations of such a formula. Author

N69-29802# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INVESTIGATING OF THE OPERATING PROCESS OF AN ENGINE WITH COMBUSTION CHAMBER IN THE PISTON

V. S. Gusarov 20 Aug. 1968 15 p refs Transl. into ENGLISH from Izv. Vyssh. Uchab. Zaved., Mashinostro. (Moscow), no. 3, 1967 p 62–67
(AD-685491; FTD-MT-24-207-68) Avail: CFSTI CSCL 21/7

The 1Ch 8.5/11 engine is a single-cylinder unit put out by the Riga Diesel Plant. A study was made of the feasibility of direct injection with the combustion chamber in the piston in this type of engine. A diagram of the modified combustion chamber with a compression ratio of 15.8 is shown. A new cylinder head was used together with the revised cylinder, which was made of aluminum. The compression ratio was changed by increasing the depth of the chamber. The axis of the chamber was displaced by 5 mm from the cylinder axis toward the spray unit so that the tip of the unit would reach the chamber. The engine was otherwise left unaltered. Various spray units with from one to four nozzle apertures were used in the tests. The test stand was equipped with an equalizing dynamo, systems for fuel supply and measuring the rate of fuel flow, engine cooling regulation, exhaust gas temperature measurement, registration of the initiation and termination of fuel spray. A stroboscopic tachometer was used for setting and monitoring the engine speed. In studying the effect of the number of nozzle apertures on operational indices, the diameters were varied to give approximately the same total cross section in all cases. It was found that optimum operating conditions are achieved with a four-aperture spray unit and a compression ratio of 15.8 without axial vorticity. Conversion to direct injection results in increased indicator efficiency chiefly due to reduced losses in cooling and incomplete combustion. Author (TAB)

N69-29834# Army Foreign Science and Technology Center, Washington, D.C.
MEASURING THE CONCENTRATION OF METALLIC WEAR PRODUCTS IN THE LUBRICATING SYSTEMS OF MOTORS
V. V. Chernyak 7 Mar. 1969 8 p refs Transl. into ENGLISH from Defektoskopiya (Sverdlovsk), v. 3, no. 4, 1967 p 86–87
(AD-685671; FSTC-HT-23-956-68) Avail: CFSTI CSCL 21/7

The electromagnetic method based on the measurement of the electromagnetic properties of contaminants is used to determine the concentration of metallic wear products in the lubricants of engines. Diagrams of the measuring apparatus are furnished. Author (TAB)

N69-29908*# General Electric Co., Cincinnati, Ohio. Nuclear Systems Programs.
THREE-STAGE POTASSIUM VAPOR TURBINE FABRICATION AND ASSEMBLY Final Report
H. E. Nichols, R. W. Fink, and W. F. Zimmerman 22 May 1969 207 p refs
(Contract NAS3-8520)
(NASA-CR-72501; GESP-223) Avail: CFSTI CSCL 21H

The three-stage potassium test turbine includes (1) refractory metal forgings in the fabrication of the first two stage wheels; (2) refractory-metal rotor blades in stages two and three; and (3) material specimens in the casing downstream of the last rotor wheel for observation of possible impingement erosion from liquid slung off the rotor periphery. The report provides a discussion of the significant fabrication problems and accomplishments, and presents a photographic description of the actual physical hardware, along with a description of turbine assembly, and a record of all hardware (weights, dimensions, etc.) prior to initiating potassium testing. It discusses only the configuration employing tip-shrouded rotor configuration. Author

N69-30097# Commissariat à l'Energie Atomique, Grenoble (France). Centre d'Etudes Nucléaires.
SPACE PROPULSION (MODERN PROPULSION PROCESSES) [PROPULSION SPATIALE (PROCEDES MODERNES DE PROPULSION)]
Jean-Louis Pabot Apr. 1969 42 p refs In FRENCH; ENGLISH summary
(CEA-BIB-140) Avail: CFSTI

This report is a review of non-chemical propellants used in space propulsion. The characteristics of the rocket motor are first given, followed by a description of the propulsion methods studied in the laboratory; particular attention is paid to nuclear and ionic propellants. In conclusion, it appears that chemical, nuclear and electrical means of propulsion are complementary; each one is suitable for a particular task in space. Author (ESRO)

N69-30180# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ROCKETS, THEIR ARRANGEMENT AND APPLICATION (CHAPTERS 5 AND 6)
G. E. Langemak et al 11 Oct. 1968 58 p Transl. into ENGLISH from the book "Rakety Ikh Ustroistvo i Primenenie" Moscow, Redakts Aviats. Lt., ONTI, NKTP, 1935
(AD-685522; FTD-MT-24-308-68) Avail: CFSTI CSCL 21/8

The book discusses basic information about reaction propulsion, fundamentals of arrangement of solid- and liquid-propellant rocket devices, and possible fields of application of these devices. The authors also give a systematic description and critical analysis of the most characteristic designs of rocket devices proposed up till now which have been described in general literature and in foreign patents. Author (TAB)

N69-30293*# Georgia Inst. of Tech., Atlanta. School of Aerospace Engineering.
BEHAVIOR OF NOZZLES AND ACOUSTIC LINERS IN THREE-DIMENSIONAL ACOUSTIC FIELDS Quarterly Report, 1 Mar. – 31 May 1969
Ben T. Zinn, Allan J. Smith, Jr., and B. Robert Daniel 31 May 1969 14 p refs
(Grant NGR-11-002-085)
(NASA-CR-98487) Avail: CFSTI CSCL 21H

Progress is reported on an experimental program to determine the response of several converging-diverging nozzles that are subjected to three-dimensional or transverse acoustic oscillation. To date a theoretical study was made of impedance tubes for three-dimensional oscillations. It was the objective of this study to obtain expressions that will describe the dependence of the amplitude of the three-dimensional pressure oscillations upon the end wall admittance, the Mach number of the mean flow, and the frequency and transverse mode of oscillation. A literature survey was made on acoustic liners and work progressed toward the design of an acoustic facility capable of closely simulating the flow conditions in an unstable liquid propellant rocket engine. S.P.

N69-30311# Deutsche Forschungsanstalt fur Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Strahlantriebe.
EXPERIMENTAL RESULTS OF THE ELECTROSTATIC ION PROPULSION SYSTEM; ESKA 18 [EXPERIMENTELLE ERGEBNISSE UEBER DAS ELEKTROSTATISCHE IONENTRIEBWERK ESKA 18]
Hans-Jusren Arlt, Guenther F. Au, and Siegfried Baumgarth Mar. 1969 31 p refs In GERMAN; ENGLISH summary
(DLR-FB-69-05) Avail: CFSTI

The principle and the design of the Kaufman ion thruster working at the DFL Braunschweig are explained. The experimental ion engine ESKA 18 and the electric circuit diagram are described. The experimental data of this thruster, as discharge characteristics, focusing characteristics and propulsion parameters, are shown in tables and diagrams. The results are discussed and the necessary optimizations for further measurements are delineated. Finally, the data of ESKA 18 are compared with the rf-ion thruster RIT 10 and the American thruster SERT II. Author (ESRO)

N69-30364# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ROCKET ENGINES
Wen-lan Feng 19 Jul. 1968 8 p refs Transl. into ENGLISH from Hang K'ung Chih Shih (Communist China), no. 2, 1960 p 6–7
(AD-685058; FTD-HT-23-297-68) Avail: CFSTI CSCL 21/8

Informational article explains mechanism of the fuel and oxidizing agent burning in the combustion chamber leading to the creation of thrust. It mentions the two important component parts of liquid fuel generators. Possible combinations of various parts of the rocket are listed. Speed error for the rocket mentioned is quite low. Comparison of thrust produced by Russian and U.S. combustion chambers is made. Problems in raising thrust are listed. The use of a testing platform is mentioned, before rocket can be fired.
Author (TAB)

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N69-29614# Universidade Mackenzie, Sao Paulo (Brazil). Centro de Radio-Astronomia e Astrofisica.
RESEARCHES ON MICROWAVE SOLAR RADIATION
Annual Report, Jan. 1968–Jan. 1969
Pierre Kaufmann Feb. 1969 18 p refs
(Grant DA-AROLD)-49-092-65-G76)
(AD-685469; CRAAM-30) Avail: CFSTI CSCL 3/2

Abstracts of papers published, accepted for publication, or prepared during 1968 are presented. These papers were concerned with research on the subjects of earth atmospheric effects, polarization of microwave solar bursts, and solar corona studies based on residual flux measurement. Various administrative activities, including a change of site for the radio observatory, are also mentioned.
A.C.R.

N69-29652*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LECTURES IN HIGH ENERGY ASTROPHYSICS
H. Oegelman, ed. and J. R. Wayland, Jr., ed. (Md. Univ., College Park) Washington 1969 170 p refs
(NASA-SP-199) Avail: CFSTI CSCL 04A

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1. CURRENT PROBLEMS OF HIGH-ENERGY ASTROPHYSICS H. Oegelman p 1–21 refs (See N69-29653 16-29)

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3. COSMIC-RAY ELECTRONS AND RELATED ASTROPHYSICAL PROBLEMS R. Ramaty p 35–48 refs (See N69-29655 16-29)

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N69-29653*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
CURRENT PROBLEMS OF HIGH ENERGY ASTROPHYSICS
H. Oegelman *In its* Lectures in High Energy Astrophys. 1969 p 1–21 refs (See N69-29652 16-29)
Avail: CFSTI CSCL 04A

Existing information is reviewed on primary cosmic radiation and general features of our galaxy and metagalaxy. Covered are processes involving energies of 10^3 eV to 10^{20} eV; measured elementary particle lifetimes and relevant parameters for protons, nuclei, electrons, photons, and neutrinos are discussed. A schematic representation of our galaxy is given and its spiral arm structure is examined through interstellar gas distribution as observed in profiles of the 21 cm hydrogen radio line emitted from the neutral hydrogen atom. The spherical halo surrounding our galaxy is attributed to a slow decrease in radio intensity in directions away from the disk. Polarization measurements of distant starlight and nonthermal radio emission analyses indicate galactic magnetic fields of 3×10^{-6} gauss, with field lines running in the plane of the galaxy.
G.G.

N69-29654*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ORIGIN, COMPOSITION, AND PROPAGATION OF THE NUCLEAR COMPONENT OF COSMIC RAYS
C. Fichtel *In its* Lectures in High Energy Astrophys. 1969 p 23–34 refs (See N69-29652 16-29)
Avail: CFSTI CSCL 04A

Origin and propagation of cosmic radiation are studied by reviewing the composition of its nucleonic component and the formation of secondaries from interactions between cosmic ray nuclei and interstellar material. The excess of heavy nuclei in the cosmic region increases generally from the medium nuclei to the iron group; nuclei with charges greater than iron also show an excess relative to helium, but the ratios of nuclei with $Z \geq 30$ and $Z \geq 40$ relative to the iron group appear to be the same as universal abundances. In general, supernovae explosions with resulting hydromagnetic shock wave propagation until relativity is reached for a small fraction of the outer envelope with subsequent conversion into cosmic rays, seems to supply radiation energy at the rate of about 10^{40} to 10^{43} ergs/sec.
G.G.

N69-29655*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COSMIC-RAY ELECTRONS AND RELATED ASTROPHYSICAL PROBLEMS
R. Ramaty *In its* Lectures in High Energy Astrophys. 1969 p 35–48 refs (See N69-29652 16-29)
Avail: CFSTI CSCL 04A

Synchrotron, bremsstrahlung, and inverse Compton scattering processes from cosmic distributions of fast electrons and thermal photons are studied by considering the effects of solar modulation, galactic propagation, electromagnetic radiation, and energy loss on cosmic ray electrons. Measurements on spectrum and charge composition of cosmic ray electrons at earth and calculated fluxes in interstellar space of total secondary electrons and positrons indicate that high energy electrons are confined in the galactic disk.
G.G.

N69-29656*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
COSMIC RAY PHOTONS
E. A. Boldt *In its* Lectures in High Energy Astrophys. 1969 p 49–83 refs (See N69-29652 16-29)
Avail: CFSTI CSCL 04A

Production and propagation of astronomical photons is interpreted by relating processes already examined in the laboratory to a black-body model, synchrotron, bremsstrahlung, Compton scattering, photoelectric absorption, etc. Parameters of radiation mechanisms and stellar statistics for X-ray sources are used to obtain electron energy densities and proton productions for the Crab Nebula and stars Cygnus and Sagitterius. G.G.

N69-29657*# Maryland Univ., College Park.
PLASMA ASPECTS OF COSMIC RAYS
D. Wentzel *In* NASA. Goddard Space Flight Center Lectures in High Energy Astrophys. 1969 p 85–91 refs (See N69-29652 16-29)
Avail: CFSTI CSCL 04A

The dynamic role of cosmic rays in determining certain properties of the galaxy is examined by assuming that the galactic disk is not in a state of equilibrium and that one part of a magnetic field line dips slightly in toward the galactic plane so that the ionized gas tends to flow downhill in this region and depresses this part of the line, while nearby higher parts are unloaded and form loops extending well above the galactic plane. Some of the loops extend so high that their field strength is insufficient to contain the cosmic ray pressure and thus cosmic rays can leave the galaxy. Quantitative calculations on this effect show that the pressure of cosmic rays is due mainly to those rays of energy below 10 GeV; these in turn are regulated by waves they generate themselves and which prevent them from streaming much faster than the instabilities present. G.G.

N69-29658*# Maryland Univ., College Park, Md. Dept. of Physics and Astronomy.
RELATIVISTIC STOCHASTIC PROCESSES
J. R. Wayland, Jr. *In* NASA. Goddard Space Flight Center Lectures in High Energy Astrophys. 1969 p 93–109 refs (See N69-29652 16-29)
Avail: CFSTI CSCL 04A

The phenomenon of cosmic ray origin is studied by using the classical theory of random processes in Brownian motion to obtain a relativistic Fokker–Planck equation. Although a particular form of this equation is solved, it is pointed out that if one chooses a different set of coordinates, the resulting equation will be one of relativistic stochastic processes. G.G.

N69-29659*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PROPAGATION OF SOLAR COSMIC RAYS IN THE INTERPLANETARY MAGNETIC FIELD
E. C. Roelof *In its* Lectures in High Energy Astrophys. 1969 p 111–135 refs (See N69-29652 16-29)
Avail: CFSTI CSCL 04A

A diffusion-convection theory is developed to explain solar cosmic ray propagation in the interplanetary plasma and the distorted production spectrum by the time the particles arrive at earth. It is shown that irregularities of the interplanetary magnetic field carried out into space by the expanding corona cause this distortion and randomize the trajectories of the particles. G.G.

N69-29660*# Hawaii Univ., Honolulu.
INTERPLANETARY DUST
L. W. Sandermann *In* NASA. Goddard Space Flight Center Lectures in High Energy Astrophys. 1969 p 137–165 refs (See N69-29652 16-29)
Avail: CFSTI CSCL 04A

Experimental evidence about interplanetary dust particles is examined in an effort to obtain their physical properties, origin, and evolution. Some of the features of zodiacal light spectra are explained with models of dielectric and metallic particles since satellite impact data give no conclusive evidence about shape, density, or composition of these particles. Nongravitational forces affect the orbits of interplanetary dust; some forces are steady while others change rapidly and shape the physical properties of the particles with time. In general, possible sources of interplanetary dust constitute: (1) asteroidal collisions; (2) fragmentation of comets; (3) capture of interstellar dust; (4) condensation of interplanetary gas; (5) ejection of lunar surface material by meteoroid impact; and (6) a primordial dust cloud residing in the outer regions of the solar system. G.G.

N69-29678# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CONTEMPORARY STATE OF INVESTIGATIONS OF THE RADIATION CLIMATE
T. G. Berlyand *In its* Mod. Prob. of Climatology 29 Nov. 1967 p 22–36 refs (See N69-29676 16-20)
Avail: CFSTI

A characterization of the development of the world actinometric network is presented. Problems of summarization of material of observations and development of indirect methods of calculation, which were the primary methods used for works on the study of the radiation regime of the earth, are analyzed. Author

N69-29679# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
STUDY OF THE SOLAR RADIATION REGIME IN THE USSR
Z. I. Pivovarova *In its* Mod. Prob. of Climatology 29 Nov. 1967 p 37–52 refs (See N69-29676 16-20)
Avail: CFSTI

A brief characterization of the study of the radiation regime of the territory of the USSR is presented. Based on generalization of many years of data of observations made by the actinometric network (over 200 stations), simple maps of the distribution of atmospheric transparency over the territory of the USSR are constructed. Clarified maps of the radiation balance of the earth's surface, and maps of summary radiation arriving at a horizontal surface and vertical surface facing to the south are presented. Author

N69-29760*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
THE COSMIC GAMMA-RAY SPECTRUM FROM SECONDARY PARTICLE PRODUCTION IN COSMIC-RAY INTERACTIONS
F. W. Stecker Jun. 1969 26 p refs Submitted for publication (NASA-TM-X-63581; X-641-69-238) Avail: CFSTI CSCL 03B

The cosmic gamma ray spectrum below 1 GeV, arising from cosmic ray p–p interactions, is calculated. Its properties are determined by the properties of secondary neutral pion production occurring at accelerator energies. An isobar-plus-fireball model is chosen for numerical calculations in which the two dominant modes of neutral pion production at accelerator energies are the production of the $\Delta(1.238)$ isobar and one fireball. Each of these modes of production then yields a component to the total gamma ray spectrum. The effect of α-p and p-α interactions on the cosmic gamma ray spectrum is also calculated. The components are summed, and the results are given in terms of both differential and integral gamma ray energy spectra. Author

N69-29781*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
PREDICTION OF SMOOTHED SUNSPOT NUMBER USING DYNAMIC RELATIONS BETWEEN THE SUN AND PLANETS
R. S. Pimm and T. Bjorn Apr. 1969 198 p refs
(Contract NAS8-21445)
(NASA-CR-98492; HREC-1445-1; LMSC/HREC-D148777) Avail: CFSTI CSCL 03B

The objective was to develop a technique for the prediction of solar activity, making use of the results of previous scientific investigations which had indicated a relation between solar activity and planet interactions. The nature of the interaction between planets and sun which might be influential in causing sunspots is not known. Twenty-one parameters, or predictors, were developed and preprocessed for a subsequent multiple, nonlinear regression analysis to determine the nonlinear relationship between each predictor and sunspot number, individually. The NONLIN algorithm was used for this purpose. These nonlinear relationships were then combined iteratively by the ITLIN program to produce the estimate of sunspot number. The entire procedure was performed for both the 11-year and 22-year cycle configurations. Future estimates of the 22-year sunspot cycle were made for various combinations of the predictors. The results, while not accurate enough for use at this time, indicate that the basic procedure is feasible. Author

N69-29833*# Geo-Science, Inc., Alamogordo, N. Mex.
SOLAR RESEARCH AND DEVELOPMENT AT SACRAMENTO PEAK OBSERVATORY Final Report, 1 Jan. 1967–31 Dec. 1968
Mark W. Jones Jan. 1969 15 p
(Contract F19628-67-C-0199)
(AD-685230; AFCRL-69-0051) Avail: CFSTI CSCL 3/2

The fundamental research work included spectral studies of solar flares, prominences, and plages with the Universal Spectrograph, and analyses of the data from the 1965 and 1966 solar eclipse expeditions. The electronics group contributed to the overall instrumentation design and development programs; these involved automation systems for the collection and reduction of solar data, control systems for the spectrographic instruments, the solar flare patrol system, the video systems, and the instrumentation systems for the solar tower. TAB

N69-30022*# National Aeronautics and Space Administration, Washington, D.C.
DETECTORS FOR ROCKET- AND SATELLITE-BORNE MEASUREMENTS OF EXTREMELY LOW DUST FLUXES [DETEKTOREN ZUM NACHWEIS EXTREM NIEDRIGER STAUBFLUESSE MIT RAKETEN UND SATELLITEN]
Manfred Feuerstein (Ph.D. Thesis - Ruprecht-Karl Univ., Heidelberg) Jun. 1969 55 p refs Transl. into ENGLISH of German thesis
(NASA-TT-F-12182) Avail: CFSTI CSCL 03B

The inadequacy of available collection methods and detectors for extremely low dust fluxes prompted this study. Several new devices, namely collection detectors for rocket experiments, a penetration detector, and semiconductor counters were investigated. The test results obtained with these devices in rocket and satellite flights, using the LUSTER experiments in 1967, Centaur flights in 1968, and Nike-Apache flights in 1968, are described. K.W.

N69-30063# Atomic Energy of Canada, Ltd., Chalk River (Ontario).
COSMIC RAY NM-64 NEUTRON MONITOR DATA-11, AND MONTHLY GRAPHS, SEPTEMBER–DECEMBER 1968
J. F. Steljes Jan. 1969 91 p
(AECL-3283) Avail: Atomic Energy of Can., Ltd., Chalk River $2.00

Uncorrected and barometer-corrected results from four Canadian cosmic ray stations are given in tabulated form for the period from September through December, 1968. Normalized graphs for the same period are also presented. The stations are Deep River, Ontario, Alert and Inuvik, Northwest Territories and Goose Bay, Labrador. Author

N69-30089# Commissariat à l'Energie Atomique, Saclay (France). Centre d'Etudes Nucléaires.
THEORETICAL GALACTIC COSMIC RAY ELECTRON SPECTRUM OBTAINED FROM SOURCES OF VARYING GEOMETRY [SPECTRE THEORIQUE DES ELECTRONS DU RAYONNEMENT COSMIQUE DANS LA GALAXIE OBTENU POUR DES SOURCES A GEOMETRIE VARIABLE]
Moses Elias Cohen Mar. 1969 47 p refs In FRENCH; ENGLISH summary
(CEA-R-3674) Avail: CFSTI

Jokipii and Meyer have recently obtained an electron density energy spectrum for cosmic rays originating in the galaxy, using integral solutions of the steady state transfer equations, by considering a circular cylindrical galactic disc as source and approximating the resulting fourth order integral. In this report, results obtained by using an arbitrary circular cylindrical source without restriction to the case of the galactic disc are presented. The integrals are treated exactly and the conclusions of Jokipii and Meyer are obtained as special cases. An exponential energy variation which, at the moment, is not observed experimentally has also been predicted. The second part of this work deals with more complicated, but perhaps more realistic models of elliptic cylindrical and ellipsoidal galactic disc sources. A very large source concentrated in a very small region gives a spectrum not unlike that for a small source distributed throughout a large volume. The model adopted is much less restrictive than the artificial conception of 'leakage time' followed by other workers. Author (ESRO)

N69-30110# Washington Univ., Seattle. Department of Atmospheric Sciences.
RADIATIVE ENERGY EXCHANGE OVER ARCTIC LAND AND SEA, 1963
Bruce J. Lieske and Desmond T. Bailey Feb. 1969 33 p refs
(Contracts Nonr-477(24); N00014-67-A-0103)
(AD-685608; SR-2) Avail: CFSTI CSCL 3/2

The components of short-wave radiation and net total radiation were measured continuously at Pt. Barrow, Alaska, from January to September during 1963. Data are presented as daily energy sums and hourly means of radiative flux density for each month. In general, the errors in the radiation data may attain plus or minus 5 - 10%. The year 1963 was climatologically anomalous in some respects. Notably it was the wettest on record. Solar data for Barrow (solar elevation, extraterrestrial solar radiative flux density, and optical air mass) are given for selected dates and times. Author (TAB)

N69-30150# Potchefstroom Univ. for Christian Higher Education (South Africa). Dept. of Physics.
COSMIC RAY NEUTRON MONITOR DATA, SANAE, ANTARCTICA, JANUARY - DECEMBER 1967
Aug. 1968 37 p
(S-2) Avail: CFSTI

The tabulated results of cosmic ray neutron monitoring are presented. Final values of pressure-corrected counts, uncorrected counts, and atmospheric pressure are included. A.C.R.

N69-30202*# Pittsburgh Univ., Pa. Space Research Coordination Center.
ROCKET INVESTIGATION OF THE AURORA BOREALIS: SOME OF ITS PROMINENT OPTICAL FEATURES AND ITS ION COMPOSITION
Truman David Parkinson (Ph.D. Thesis) 1969 135 p refs
(Grant NGL-39-011-002)
(NASA-CR-101681; SRCC-97) Avail: CFSTI CSCL 03B

Analysis of data from a series of three sophisticated Aerobee rocket experiments flown into auroral displays has yielded much information concerning the excitation mechanisms of several optical emissions. Laboratory measured cross sections for the N_2+ (0-0) first negative band, its observed volume emission rate, and measured secondary electron spectra allow calculation of the electron fluxes responsible for the N_2 first positive bands, the O_2+ first negative bands, and the OI green line at 5577Å. The molecular emissions can be accounted for in terms of direct electron impact excitation from the appropriate neutral molecule. The classical source of the green line, direct electron impact excitation of O, is shown inadequate. Dissociative excitation of O_2 and dissociative recombination of O_2+, each dominant in its own region, are capable of producing the green line. Further confirmation of this dual source comes from a measurement of the quenching of the O(^{1}D) state as indicated by the OI red line at 6300Å. Author

N69-30304# Potchefstroom Univ. for Christian Higher Education (South Africa). Dept. of Physics.
COSMIC RAY NEUTRON MONITOR DATA, SANAE, ANTARCTICA, FEBRUARY 1964 – DECEMBER 1966
Dec. 1966 105 p
(S-1) Avail: CFSTI

Cosmic ray neutron monitoring data are presented in tabular form. Final values for pressure corrected counts, uncorrected counts, and atmospheric pressure are included. A.C.R.

N69-30325# Potchefstroom Univ. for Christian Higher Education (South Africa). Cosmic Ray Research Unit.
REPRESENTATION OF BALLOON-ALTITUDE-INTENSITY DATA IN TERMS OF PRIMARY AND SECONDARY COSMIC RAY PARTICLES ABSORPTION LENGTHS
M. L. Grundlingh and P. H. Stoker [1968] 20 p refs
Avail: CFSTI

A formula representing the variation in cosmic ray intensity was deduced from the primary absorption equation and the secondary particle absorption and production equation. This new formula was used on data obtained from a series of balloon flights at different locations. Geiger counters and telescopes were used to measure attenuation length for meson and electron components of cosmic rays and to show their dependence on cutoff rigidity. Absorption lengths were also determined from the altitude variation of energetic neutrons measured by a proton recoil counter and lower energetic neutrons measured by a counter surrounded by a wax moderator. J.A.M.

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N69-29005 Pennsylvania Univ., Philadelphia.
THE ECLIPSING SYSTEMS Z DRACONIS AND W URSAE MINORIS
Edward Joseph Devinney, Jr. (Ph.D. Thesis) 1968 131 p
Avail: Univ. Microfilms: HC $8.40/Microfilm $3.00 Order No. 69-85

Light curves in yellow and blue light have been obtained for the eclipsing variables Z Draconis and W Ursae Minoris, and orbital elements have been obtained using the Russell-Merrill model and prescriptions. The yellow and blue light curves of Z Draconis are not satisfied by the same set of geometrical elements. It is suggested that this discrepancy is related to long-standing "complications" seen in the light curve, thus seeming to exclude more transient phenomena, such as material at the Lagrangian points as the cause. A mode of mass loss suggested by Kruszewski may be at work in the system as seen by its history of period variation. The yellow and blue light curves of W Ursae Minoris are satisfied by a single set of geometrical elements. They were solved as above for Z Draconis and absolute properties of the system were found on the assumption that the secondary component contacts its Roche lobe, using a one-spectrum radial velocity curve of Sahade. Dissert. Abstr.

N69-29007 California Inst. of Tech., Pasadena.
ACTIVITY IN THE CRAB NEBULA
Jeffrey Drexel Scargle (Ph.D. Thesis) 1968 174 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-531

Changes in the structure shown by the continuous emission from the Crab Nebula are investigated observationally and theoretically. A beautiful series of 200-inch plates from 1955 to the present provides the data on the morphology of the activity. Near the center of the nebula is a striking series of strongly polarized, elongated features called "wisps." The wisps in this series appear to move at velocities a significant fraction of the speed of light. The first and most prominent wisp is probably a permanent feature which moves about a characteristic position. Nearby is a fainter but similar region which sometimes shows one or more wisps. Centrally placed with respect to these two regions is a very thin wisp which shows more restricted motions. Since the two active regions are symmetrically placed about it, this thin wisp is in a sense the center of the activity. Dissert. Abstr.

N69-29011 Pennsylvania Univ., Philadelphia.
PHOTOMETRIC STUDIES OF FOUR SOUTHERN HEMISPHERE VARIABLE STARS
Carleón Rollin Chambliss (Ph.D. Thesis) 1968 193 p
Avail: Univ. Microfilms: HC $9.80/Microfilm $3.00 Order No. 69-75

This dissertation presents findings from photoelectric studies of the Southern Hemisphere variable stars SV 418, S Chamaeleonis, AU Puppis, and HD 116994. Dissert. Abstr.

N69-29038# Iowa Univ., Iowa City. Dept. of Physics and Astronomy.
ON THE SOLAR FLARE OF 8 JULY 1966
J. A. Van Allen and C. D. Wende Feb. 1968 12 p refs
(Contract Nonr-1509(06))
(AD-684438; Rept-69-11) Avail: CFSTI CSCL 03/2

Absolute solar x-ray flux in the wavelength range 2 to 12Å is reported for the 3B flare of 8 July 1966. The measurements were made with satellites Explorer 33 and 35. Also given is the solar radio flux density at 18.375 MHz as observed by the North Liberty Radio Observatory. Author (TAB)

N69-29082 Washington Univ., Seattle.
THE CARBON NITROGEN AND OXYGEN ABUNDANCES OF THE K GIANTS ALPHA BOOTIS ALPHA SERPENTIS BETA GEMINORUM AND EPSILON PEGASI
Thomas Frederick Greene (Ph.D. Thesis) 1968 160 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 69-1176

Abundances in the K giants were determined using C_2, CN, CI and [OI] lines from 2 and 6 Å/mm spectrograms. Well iterated, local thermal equilibrium model atmospheres and an analysis method which is independent of oscillator strengths were employed in the reduction. The sun was employed as the comparison reduc- in the reduction. The sun was employed as the comparison star. Band intensities and line equivalent widths were predicted using weak line theory. A graphical solution technique was employed to obtain the carbon and oxygen abundances. The nitrogen abundance was then deduced from the CN data. Poor lower bounds on C^{12}/C^{13} in each of the four stars were determined by means of $C^{12}N$ red (4,0) or (2,0) band rotational lines. A discrepancy between theoretical and observed relative oscillator strengths in the CN red system was noted. The final atmospheric abundances, particularly the nitrogen enhancements, were in good agreement with recent predictions based on detailed stellar evolution calculations. Dissert. Abstr.

N69-29088# Weapons Research Establishment, Salisbury (Australia).
A SIX DEGREES OF FREEDOM TRAJECTORY PROGRAM FOR RIGID MULTI-STAGE ROCKET PROPELLED VEHICLES INCLUDING A SPECIAL ABRIDGEMENT TO COMPUTE BOMBLET TRAJECTORIES
J. S. Hunter Sep. 1968 71 p
(PB-182751; WRE-TN-HSA-135) Avail: CFSTI CSCL 19D

This note describes a program to compute trajectories of a missile having up to three stages. The vehicle is considered to be a rigid body with any number of fins and possessing six degrees of freedom in space. The program includes the effects of certain launcher constraints, pulse rockets, jet damping, thrust misalignment, aerodynamic and mass asymmetries, and the rotation of the earth. Provision is made for the inclusion of Magnus moments in addition to yaw induced forces and moments tabulated as functions of Mach number, roll orientation, and incidence. The program is written in FORTRAN 2 for an IBM 7090 computer. A listing of the program is presented. In addition, a shortened version of the program, particularly suited to the simulation of bomblet trajectories, is outlined, and variations of this abridged version from the main program are noted. Author (USGRDR)

N69-29089# Environmental Science Services Administration, Boulder, Colo. Space Disturbances Lab.
AN ANALYSIS OF SUDDEN IONOSPHERIC DISTURBANCES ASSOCIATED WITH THE PROTON FLARE OF 1522 UT, 28 AUGUST 1966
Richard F. Donnelly Nov. 1968 36 p refs
(AD-682249; ERL-92-SDL-6) Avail: CFSTI CSCL 4/1

The report consists of two main parts: (1) a summary of the X-ray and extreme ultraviolet (EUV) radiation deduced from ionospheric data for the proton flare of August 28, 1966; and (2) a detailed discussion of the analysis of this ionospheric data as an example of our general analysis procedures for sudden ionospheric disturbances, especially sudden frequency deviations. The ionospheric data show that a very large burst of extreme ultraviolet radiation of about 7 ergs/sq cm sec above the earth's atmosphere occurred during the flare. The time dependence of this burst agrees closely with the 8,800 and 10,700 MHZ solar radio bursts, but does not agree with bursts at frequencies < or = 2800 MHZ. The soft X-ray enhancement deduced from ionospheric data peaked about 4 min after the euv burst. Author (TAB)

N69-29115*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
DETERMINATION OF LUNAR EQUATORIAL RADIUS USING IMAGE-MOTION COMPENSATION SENSOR DATA FROM LUNAR ORBITER I
Harold R. Compton and William R. Wells Washington Jun. 1969 21 p refs
(NASA-TN-D-5231) Avail: CFSTI CSCL 03B

The telemetry data from the image-motion compensation sensor (V/H sensor) on the Lunar Orbiter 1 spacecraft were analyzed to determine the radius of the moon in the equatorial region from about 50° west to about 40° east selenographic longitude. The results indicate that over this region the lunar radii determined from these data vary from a minimum of 1734.6 km to a maximum of 1738.6 km. The arithmetic mean of these radii is 1736.5 km or about 1.5 km smaller than the mission planning value of 1738.09 km prior to the Ranger and Lunar Orbiter series of spacecraft. An asymmetrical bulge toward the earth was noted in the general area of Sinus Medii. The values of the lunar radii were compared with those determined from a harmonic analysis, Ranger 8 impact analysis, radar measurements, and photogrammetric techniques. Except for the harmonic analysis, these radii are in good agreement with the Lunar Orbiter values. Author

N69-29131*# Techtran Corp., Glen Burnie, Md.
MICROMETEORITES IN NEAR-EARTH SPACE ACCORDING TO OBSERVATIONS OF THE KOSMOS-163 SATELLITE [MIKROMETEORY V OKOLOZEMNOY KOSMICHESKOM PROSTRANSTVE PO NABLYUDENIYAM NA SPUTNIKE 'KOSMOS-163']
B. P. Konstantinov et al Washington NASA Jun. 1969 10 p refs Transl. into ENGLISH from Russian Acad. of Sci. Paper No. 186
(Contract NASw-1695)
(NASA-TT-F-12385) Avail: CFSTI CSCL 03B

In 1967, the Cosmos-163 satellite performed measurements of the flux of micrometeorites in near-earth space using interference-resistant acoustic detectors. The flux of particles with masses exceeding $7 \cdot 10^{-7}$ g amounted to $3.5 \cdot 10^{-9}$ particles/m^2 sec. These data confirm completely the results produced by the Cosmos-135 satellite, contradicting the hypothesis of the existence of a dust cloud around the earth. Extended measurements performed during the time of the principal annual meteorite showers showed no manifestation of the activity of these showers in this area of particle masses. Author

N69-29137 California Inst. of Tech., Pasadena.
MOTIONS AND STRUCTURE OF THE FILAMENTARY ENVELOPE OF THE CRAB NEBULA
Virginia Louise Trimble (Ph.D. Thesis) 1968 138 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 69-538

Proper motions have been measured for 132 line-emitting filaments in the Crab Nebula on direct plates taken with the 100 and 200-inch telescopes. These motions, if assumed constant and extrapolated backwards in time, converge toward a point about 12" southeast of the double star near the center of the nebula. The filaments approach, on the average, most closely to that point or expansion center in about the year 1140, indicating that the expansion has been somewhat accelerated. Proper motions and radial velocities were measured for an additional 126 features on the same direct plates and Mt. Wilson and Palomar spectra. These, along with other, nondynamical data, indicate a most probable distance to the object of 2.02 kpc. Two projections of the nebula perpendicular to the one seen in the plane of the sky are constructed and do not differ significantly from that presented. Dissert. Abstr.

N69-29138 California Univ., San Diego.
THE ATMOSPHERE, CLOUDS, AND SURFACE CONDITIONS OF VENUS, SPALLOGENIC RARE GASES AND THE CAVITIES IN IRON METEORITIES
John Simpson Lewis (Ph.D. Thesis) 1968 135 p
Avail: Univ. Microfilms: HC $6.40/Microfilm $3.00 Order No. 68-15686

The spectroscopic determinations of CO_2, CO, H_2O, HCl, and HF in the atmosphere of Venus are shown to have a simple and consistent interpretation: that the atmosphere is in chemical equilibrium with the lithosphere at some quite well-defined temperature and pressure. A model-independent estimate of the temperature in the cool regions is found to be $540 \pm 30°K$. The surface pressure is more model-dependent, but almost certainly must lie in the range 5 to 20 bars. This conclusion reinforces the interpretation of the microwave emission which attributes it to high surface temperatures, not ionospheric or cloud-droplet discharge mechanisms. The abundances of the cosmic-ray-produced nuclides ^3He, ^{21}Ne, and ^{38}Ar in several meteorites were measured in attempt to reconstruct the conditions of origin of the large cavities occasionally found in large iron meteorites. Dissert. Abstr.

N69-29252*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
ASTEROID BELT METEOROID HAZARD STUDY
D. J. Alderson and M. Neustadt 1 Jul. 1968 97 p refs
(Contract NAS7-100)
NASA-CR-101568; JPL-TM-33-361) Avail: CFSTI CSCL 03B

A mathematical model is given for the probability, $P(S)$, of successfully traversing the asteroid belt, or the probability $P(0)$, of zero penetrations of the spacecraft shield. The spacecraft is represented by a 26-sided convex polyhedron. The spacecraft trajectory is assumed to be in the form of an elliptical orbit. The meteoroid capability of penetrating the spacecraft shield is included as a function of meteoroid size, density and relative velocity; and shield thickness, density and hardness. The probability, $P(0)$, is calculated as a function of spacecraft size, surface area, shield thickness and shield mass. Two cases are considered: uniform shielding over the entire surface of the spacecraft and optimum shielding so as to maximize $P(0)$ for a given spacecraft shape, size and shielding mass. Author

N69-29392 Pennsylvania Univ., Philadelphia.
ON THE OBSCURATION HYPOTHESIS OF R CORONAE BOREALIS
Anthony Galatola (Ph.D. Thesis) 1968 96 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 69-103

The variation of light from R CrB has been ascribed to the condensation of carbon near the star. However, there has been, to date, no investigation of the exact nature of the light variation. In this dissertation the behavior of the light curve of R CrB is investigated on the basis of a simple model. This model assumes that a shell of gas is ejected from the star with some initial velocity. As the shell moves away from the star carbon condenses within the shell, thereby obscuring the light from the star. The R CrB was observed in three colors by photoelectric photometry and the data was transformed to the UBV magnitude system, taking into account the effects of the differences in the color indices of the comparison and variable stars. The ratio of the monochromatic absorption coefficients at the effective wavelengths of the yellow, blue and ultraviolet filters was found. It was then shown that the effective size of the carbon particles is about 0.05 microns. Dissert. Abstr.

N69-29461 Washington Univ., Seattle.
AN ASYMPTOTIC SOLUTION FOR A CLASS OF PERIODIC ORBITS OF THE RESTRICTED THREE-BODY PROBLEM
James Edward Lancaster (Ph.D. Thesis) 1968 180 p
Avail: Univ. Microfilms: HC $8.20/Microfilm $3.00 Order No. 69-1190

Uniformly valid asymptotic solutions of the restricted three-body problem are used to find a one-parameter family of periodic orbits which pass close to both primaries and which have commensurability of 1/2 in the earth–moon synodic system. The work of Lagerstrom and Kevorkian on earth-to-moon trajectories is reexamined using a more general matching procedure. As a result the motion near the moon is determined to a higher order of accuracy, and the Jacobi integral is shown to remain constant to order μ, where μ, the ratio of the mass of the moon to the total mass, is assumed small. The work of Lagerstrom and Kevorkian is also extended to include perturbed elliptical orbits of high eccentricity. Nonuniformities due to the choice of independent variable require a boundary layer correction for motion near the apogee. Dissert. Abstr.

N69-29467# Hull Univ. (England). Dept. of Applied Physics.
INFRARED ASTRONOMICAL INSTRUMENTATION: POLARIMETRY AND MULTIPLEX RADIOMETRY Final Scientific Report, 1 Jul. 1966–30 Sep. 1967
Roger F. Edgar and David Clarke Nov. 1967 167 p refs
(Contract AF 61(052)-968)
(AD-684588; AFCRL-68-0107) Avail: CFSTI CSCL 3/1

The need for infrared polarimetric measurements of radiation from astronomical bodies is discussed. Various methods are open to us for combining polarimetric and infrared techniques for making such measurements. Two possible techniques were investigated theoretically and a prototype instrument is described that will allow comparison of these methods for measuring the parameters of linearly polarized radiation. Several methods of increasing the efficiency of infrared radiometric systems are considered. One of these, using moire fringes to obtain a Fourier transform of an image intensity distribution is studied in detail; full theory and some experimental results are given. The problems of retrieving the image intensity distribution from its Fourier transform by both analogue and digital methods are investigated. Possible applications of this and other multiplex methods to problems other than infrared radiometry are noted. Author (TAB)

N69-29557*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
TRIM ATTITUDE, LIFT AND DRAG OF THE APOLLO COMMAND MODULE WITH OFFSET CENTER-OF-GRAVITY POSITIONS AT MACH NUMBERS TO 29
Charles E. De Rose Washington (NASA-TN-D-5276) Avail: CFSTI CSCL 22A

Measurements have been made with free-flight test models of the drag, lift, and trim attitude of a shortened version of the Apollo Command Module for Mach numbers 10 to 29 and free-stream Reynolds numbers 20,000 to 300,000. The tests were performed in a hypervelocity free-flight aerodynamic facility, using models launched from a 1.27-cm bore light-gas gun. Two center-of-gravity positions (offset from the model centerline by 0.046 and 0.028 diameter) were investigated. Resulting trim angles were 151° and 152°, respectively. Lift/drag ratios for the two trim angles were 0.435 and 0.255. Both trim angle and lift/drag ratio showed no variation with Mach number or Reynolds number within the limits investigated. Lift and drag data obtained from this investigation compare quite closely to those obtained from previous wind-tunnel tests and from Apollo flight results. Good agreement of the trim angles was obtained when, in each case, the location of the center of gravity was referenced to the axis of symmetry of the primary pressure supporting surface, the blunt face. Author

N69-29688*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
TRANSLUNAR ABORT TECHNIQUES FOR NONFREE-RETURN MISSIONS
Gus R. Babb, Jr. Washington Jul. 1969 26 p ref
(NASA-TM-X-1806) Avail: CFSTI CSCL 22A

A method of translunar abort for nonfree-return missions is considered in which the service module is jettisoned (more than doubling the abort propulsion capability of the lunar-module descent propulsion system) before the transearth maneuver is performed. During the transearth flight, the lunar module provides the life-support and power requirements for the crew. Author

N69-29580# California Inst. of Tech., Pasadena. Owens Valley Radio Observatory.
HIGH RESOLUTION OBSERVATIONS OF RADIO SOURCES. 4
Marshall H. Cohen 1969 105 p refs
(Contract N00014-67-A-0094)
(AD-685253; Rept-1969-4) Avail: CFSTI CSCL 03/2

Three principal methods are used to obtain high angular resolution at radio wavelengths: interferometry, lunar occultations, and interplanetary scintillations. These methods are reviewed and compared. Typical results are presented. A general tabulation of all interferometric results at resolution higher than one second of arc is also included. Author (TAB)

N69-29728# Oulu Univ. (Finland). Aarne Karjalainen Observatory.
GRAVITATIONAL REDSHIFT AND QUASI-STELLAR OBJECTS
K. A. Haemeen-Anttila [1967] 5 p refs Submitted for publication
Avail: CFSTI

Criticism against the gravitational interpretation of the redshift in the spectra of QSO's consists of three items: high electron density, differential gravitational redshift, and the small thickness of the line-emitting layer. Since some phenomena suggest that the QSO's are not at cosmological distances, a mathematical model was constructed in which the difficulties imposed by gravitational redshift were avoided. The model assumed that the QSO's are relatively cool bodies having eruptive atmospheres; the eruptions were considered to rise radially from the surface and then to fall back. The surface temperature was lowered and the entire spectrum generated from the eruptive layer in which rapid nonthermal particles and gas masses penetrating each other gave an impression of high electron temperature. The thickness of the emitting layer then was not determined by ionization and excitation but by the average height to which the average eruptions were able to rise. Despite magnetic forces, it was assumed that gravitation was the main factor determining this height. Author

N69-29736*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
INTERPLANETARY PROBE MISSIONS WITH SOLAR-ELECTRIC PROPULSION SYSTEMS
Charles L. Zola Washington Jul. 1969 41 p refs
(NASA-TN-D-5293) Avail: CFSTI CSCL 22A

A preliminary study is made of trajectories and propulsion system design parameters for solar electric propulsion spacecraft for several interplanetary missions. Using the Atlas–Centaur as a common launch vehicle, payload capability comparisons are also made for each mission between the solar electric propulsion system and an alternative high performance chemical propulsion upper stage. Payload capability of the solar electric system is at least 300 kilograms for flyby missions to Jupiter, Saturn, Uranus, and Neptune, with trip times competitive with or shorter than those of ballistic systems. Loose elliptic capture missions to these four planets, as well as Mars and Mercury, can be accomplished with at least 200 kilograms of payload. Author

N69-29748*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
A REVIEW OF GODDARD RANGE AND RANGE RATE SYSTEM MEASUREMENTS AND DATA PROCESSING TECHNIQUES
T. J. Grenchik and B. H. Putney Apr. 1969 42 p refs Submitted for publication
(NASA-TM-X-63572; X-551-69-137) Avail: CFSTI CSCL 22C

A description is presented of the Goddard range and range rate systems' measurements, limitations of these measurements, and effects of partial processing of the measurement data prior to final orbit computation. The description of measurement of satellite radial velocity, i.e., range rate, is given special attention. Author

N69-29749*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SATELLITE DATA RECOVERY AND QUALITY FOR LOW ELEVATION TRACKING ANGLES
Thomas J. Kerras and Richard C. Lee May 1969 79 p refs Submitted for publication
(NASA-TM-X-63575; X-560-69-208) Avail: CFSTI CSCL 22C

A PCM telemetry performance monitor was developed which provides a data recovery and data quality analyses of a recorded satellite pass, along with a strip chart presentation of pertinent characteristics of tape recorded signals. This monitor enables one to perform quantitative and qualitive analyses of a PCM telemetry signal. The evaluator was first used to examine the degradation of telemetry data due to low elevation tracking angles for the OGO-D and OSO-F satellites from several STADAN stations. These results were correlated with the world maps, predictions, telemetry schedules, and the antenna profiles. Bit error rates are more than 10^{-2} at low elevation angles and become less than 10^{-5} as the elevation angle increases. Generally, data acquired near the horizon are either lost or severely degraded. Author

N69-29770# Arizona Univ., Tucson. Lunar and Planetary Lab.
RESEARCH DIRECTED TOWARD A LUNAR PHYSIOGRAPHIC STUDY Final Report, 1 Dec. 1964–28 Feb. 1967
Gerard P. Kuiper, David W. G. Arthur, Ewen A. Whitaker, Robert G. Strom, and Harry J. Connors Nov. 1968 13 p refs
(Contract AF 19(628)-4332)
(AD-685223; AFCRL-68-0648) Avail: CFSTI CSCL 03/2

Relative lunar altitude research and selenodetic measures performed under this contract are published in LPL Comm. 72, 74, 75, 76, 77, 78; and yet to be published in 127, 128, and 129. A direction-cosine method has been developed and comparator measures have been performed to determine relative lunar altitudes from shadow measured on earth-based lunar photographs. Final refraction-free photographic coordinates have been determined for coordinate measures on 25 Yerkes lunar star-trailed photographs. An oscillating plate-holder device has been developed for a better determination of effective focal length calibration for selenodetic test plates (LPL Comm. 73). The provided Mann Comparator has been impersonalized to increase the rapidity of selenodetic measures. The completion and distribution of the Consolidated Lunar Atlas and its general acceptance by lunar researchers has proven to be a significant contribution under this contract. Author (TAB)

N69-29772# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
PHOTOELECTRIC IMAGING DEVICES FOR ASTRONOMY
Robert C. Beal Jul. 1968 73 p refs
(Contract NDw-62-0604-c)
(AD-685200; APL-TG-1011) Avail: CFSTI CSCL 03/1

In this paper current techniques used in sensitive photoelectric imaging devices are investigated. An ideal imaging device is defined in terms of parameters that are directly related to the

properties of a real device. Characteristics of a real device such as resolution, detectivity, and quantum efficiency are discussed in terms of basic device construction. The design of several types of image tubes that have found applications in astronomy are discussed in detail. The tubes are compared with regard to several performance parameters including resolution, detectivity, and information capacity. Some attempt is also made to consider such practical aspects as cost, complexity, and availability. Several specific experiments are described that were performed on one of the image tubes discussed--the secondary electron conduction tube. Finally, a concise summary of the present status of image devices for astronomy is given and some prospects for future improvements are discussed. Author (TAB)

N69-29795*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SPACE PROGRAMS SUMMARY NO. 37-56, VOLUME 1 FOR THE PERIOD 1 JANUARY TO 28 FEBRUARY 1969. FLIGHT PROJECTS
31 Mar. 1969 52 p refs
(Contract NAS7-100)
(NASA-CR-101585; JPL-SPS-37-56-Vol-1) Copyright. Avail: CFSTI CSCL 22A

Summary data are included on the Mariner Mars 1969 project, the Mariner Mars 1971 project, and Viking project. The primary objective of the Mariner Mars 1969 project is to make two flyby exploratory investigations of Mars in 1969, which will set the basis for future experiments; the secondary objective is to develop Mars mission technology. The status of this mission is reviewed, including the spacecraft system test and launch operations, systems analysis, telecommunications, guidance and control, and data automation subsystem testing. The primary objective of the Mariner Mars 1971 project is to place two spacecraft in orbit around Mars which will be used to perform scientific experiments directed toward achieving a better understanding of the physical characteristics of that planet. The project status of this mission is summarized. The Viking project is directed to perform scientific experiments on Mars in 1973. An orbiter system and lander system will be developed for this mission. B.P.

N69-29810*# Northrop Space Labs., Huntsville, Ala.
PREFEASIBILITY STUDY OF A SPACE ENVIRONMENT MONITORING SYSTEM (SEMOS)
Chou Chih Kang, B. D. De Baryshe, A. S. Hill, and M. C. Thadani
8 Apr. 1969 99 p refs
(Contract NAS8-20082)
(NASA-CR-61278) Avail: CFSTI CSCL 03A

The need for an earth orbital system to continuously monitor the near-earth and space environment and to assist in monitoring certain aspects of the earth's atmosphere has been established. Preliminary concepts of a Space Environment Monitoring System (SEMOS) were developed and are presented. It was shown that a reasonable concept is feasible within the framework of the Apollo Applications Program (AAP) leading to an advanced operational mission using Apollo hardware. Alternate system concepts using unmanned synchronous stations, satellite buoys and/or rocket probes or balloons show merit at this time. In general, a clear distinction between an operational monitoring system and a scientific experiment system was not apparent during the study. Considerable analysis is necessary before an intelligent SEMOS concept and its place in the national space program can be proposed. Author

N69-29812*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
LUNAR ORBITER GRAVITY ANALYSIS
J. Lorell 15 Jun. 1969 34 p refs
(Contract NAS7-100)
(NASA-CR-101637; JPL-TR-32-1387) Copyright. Avail: CFSTI CSCL 22A

This report presents the results of analyzing the tracking data from the five Lunar Orbiter spacecraft. Emphasis is placed on the long-arc evaluation, to which most of the work was directed, rather than on the mascon analysis. The model of the moon's gravity field that has been derived from the long-arc analysis is interpreted in terms of the moon's mass distribution. The results are evaluated from the point of view of consistency and of statistical significance. In particular, the various factors contributing to the uncertainty in the estimation process are discussed. Author

N69-29836*# Stanford Univ., Calif. School of Engineering.
MOON LAB: PRELIMINARY DESIGN OF A MANNED LUNAR LABORATORY. A Stanford/Ames Summer Faculty Workshop Study, 24 Jun. - 6 Sep. 1968
Jack W. La Patra and Robert E. Wilson Aug. 1968 395 p refs
(Contract NSR-05-020-151)
(NASA-CR-73342) Avail: CFSTI CSCL 22A

The material in this study is arranged according to the three phases of development: criteria and assumptions used in the design and the evolution of the MOONLAB up to 1985, its appearance by 1985, and its prospects after 1985. The objectives and benefits of establishing a lunar laboratory are examined, and the factors influencing the base design are considered. Among these factors are site selection, scientific instrumentation, personnel, life support, protection, lunar farming, shelter construction, power and communications, and costs. The scientific mission activities in the applicable physical sciences, biology, biomedicine, behavioral science, and agriculture are analyzed in detail. Considered are also mobility requirements, emergency procedures and backup, logistics and resupply, resources exploitation, and human engineering problems. K.W.

N69-29863*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
PULSED X-RAY EMISSION OF NP 0532 IN MARCH 1969
E. A. Boldt, U. D. Desai, S. S. Holt, P. J. Serlemitsos, and R. F. Silverberg Jun. 1969 10 p refs
(NASA-TM-X-63582; X-611-69-245) Avail: CFSTI CSCL 03B

A measurement of the pulsed X-ray emission associated with the pulsar NP 0532 in the Crab Nebula is recorded. This information was obtained with a six element detector flown onboard an Aerobee 150 rocket from White Sands, N. M., which was launched on March 18, 1969 at 03:15 UT. The NP 0532 is the only known pulsar to have detectable emission extending from the radio band to energies exceeding 30 KEV. This measurement is one of the two existing that can provide information concerning the history of NP 0532 prior to its discovery in the radio and optical band. Since the energy output of this object is generally accepted to have as its origin the dissipation of rotational energy, knowledge of the period of pulsation as a function of time is of special interest. Author

N69-29881*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ARTIFICIAL AURORA EXPERIMENT: POSITION MEASUREMENTS OF AURORAL RAYS AND COMPARISON WITH PREDICTIONS
Gilbert D. Mead, Jaylee M. Mead, and T. Neil Davis (Alaska Univ.) Jun. 1969 23 p refs
(NASA-TM-X-63578; X-611-69-221) Avail: CFSTI CSCL 03B

An electron accelerator, launched aboard an Aerobee 350 rocket, produced four auroral rays which were detected with image-orthicon television systems at two ground stations. The experiment was to test the feasibility of generating artificial aurorae by injecting electrons into the upper atmosphere from a rocket-borne accelerator. The optical observations, the techniques employed to determine the position of the observed rays, the method used to predict the location of the rays from knowledge of the rocket orbit and the local geomagnetic field, and a comparison of the predicted

and observed positions are described. It is found that the lower ends of the observed rays were located at altitudes of approximately 104 to 106 km; the upper ends were less well defined, ranging from around 120 to 130 km. The predicted positions were separated from the observed ones by less than 0.1° of arc, or about 400 meters. Author

N69-29941*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
TWO-TWENTY keV X-RAY SKY BACKGROUND
E. A. Boldt, U. D. Desai, S. S. Holt, and P. J. Serlemitsos Jun. 1969 16 p refs Presented at the 37th IAU Symp. on Non-Solar Gamma and X-ray Astronomy, Rome, 10 May 1969
(NASA-TM-X-63583; X-611-69-248) Avail: CFSTI CSCL 03B

The diffuse background of X-rays over a band of the sky extending from Scorpius to the north galactic pole is found to be isotropic to within 5%. A comparison with spectra at higher energies indicates that the lower energy spectrum is flatter, corresponding to an apparent unit change in spectral index within the band 20 to 80 keV. A spectral break in this energy region was discussed in connection with the collisional energy loss lifetime for metagalactic protons that radiate X-rays via inverse bremsstrahlung collisions with the ambient electrons of the intergalactic medium. Author

N69-30016*# California Univ., Berkeley. Space Sciences Lab.
SOLAR VELOCITY FIELDS: FIVE MINUTE OSCILLATIONS AND SUPERGRANULATION
Andrew S. Tanenbaum, John M. Wilcox, Edward N. Frazier, and Robert Howard 2 May 1969 34 p refs Submitted for publication *Its* Ser. 10, Issue 16
(Grants NGR-05-003-230; NsG-243; NSF GA-1319; Contract Nonr-3656(26))
(NASA-CR-101688) Avail: CFSTI CSCL 03B

One-dimensional magnetograph scans were used to study the five-minute photospheric velocity oscillations and the supergranulation. The oscillations in wing brightness lead the oscillations in velocity by less than 90° in the photosphere, and about 90° in the chromosphere, suggesting that there are traveling waves at lower levels and standing waves at higher levels. Downward flows were observed to be coincident with the chromospheric network confirming the hypothesis that material is flowing downward at supergranular boundaries. Author

N69-30023# California Inst. of Tech., Pasadena. Owens Valley Radio Observatory.
A MEASUREMENT OF THE GALACTIC MAGNETIC FIELD USING THE PULSAR PSR-0833-45
R. D. Ekers, J. LeQueux, A. T. Moffet, and G. A. Seielstad 1969 14 p refs Submitted for publication
(AD-685668; Rept-5) Avail: CFSTI CSCL 03/2

The radiation from PSR 0833-45 is strongly linearly polarized. Measurements at 21, 18 and 13 cm show a rotation measure of +33 + or - 5 radian/sq m. Combined with the published value of the dispersion measure this yields a mean value of 0.73 + or - 0.13 microgauss for the longitudinal component of the galactic magnetic field along the inner face of the Orion arm. Author (TAB)

N69-30034# Madrid Univ. (Spain). Observatorio Astronomico de Madrid.
SUNSPOTS: EXTRACTS FROM THE YEARBOOK OF MADRID ASTRONOMICAL OBSERVATORY FOR 1969 [LAS MANCHAS DEL SOL: SEPARATAS DEL ANUARIO DEL OBSERVATORIO ASTRONOMICO DE MADRID PARA 1969]
M. Lopez Arroyo 1968 139 p refs In SPANISH
Avail: CFSTI

A study of sunspots with subject material divided into four sections is presented. (1) Observations and opinions of early astronomers are traced, together with later concepts which form the basis for present day understanding of sunspots. (2) General physical characteristics of sunspots are investigated including structural forms, area classifications, radial movements, structure of the penumbra and nucleus, magnetic field configuration, temperature, grouping of sunspots, and the annual cycles of solar activity. (3) Theories on the constitution of sunspots are reviewed with separate presentations for individual astronomers. (4) Several theories that attempt to explain the collective properties of sunspots are included, and the polarization characteristics of sunspots are discussed. Transl. by D.L.G.

N69-30080# Observatoire de Paris (France).
ARTIFICIAL SATELLITES. OBSERVATIONS MADE AT BORDEAUX (1962–1964; ECHO AND OTHERS) [SATELLITES ARTIFICIELS. OBSERVATIONS FAITES A BORDEAUX (1962–1964 ECHO ET DIVERS)]
Paul Muller 1968 153 p In FRENCH; ENGLISH summary *Its* Publ. 20 Sponsored by CNES
Avail: CFSTI

The observations include 5482 points obtained during 471 transits. The transits are given in chronological order with the following data: hours, minutes, seconds, tenths and hundredths (universal time); azimuth (from South towards West) in degrees and minutes; elevation in degrees and minutes, corrected for refraction; right ascension in degrees and hundredths; declination in degrees and hundredths. The equatorial coordinates are referred to the equinox of the date, as was done in the former publications. Author (ESRO)

N69-30084# Smithsonian Astrophysical Observatory, Cambridge, Mass.
IMPLICATIONS OF MICROWAVE SPECTROSCOPY FOR THE WATER-VAPOR CONTENT OF THE VENUS ATMOSPHERE
J. B. Pollack and A. T. Wood, Jr. May 1968 13 p refs
(REPT-805-44) Avail: Issuing Activity

From a comparison of theoretical and observed microwave brightness temperatures of Venus at 1.35 cm, the center of a water vapor line, an upper limit of 0.8 percent to the water vapor mixing ratio in the lower atmosphere was obtained. This limit is consistent with the amount of water vapor detected by Venera 4, the existence of water ice clouds, and a greenhouse effect caused by water vapor and carbon dioxide. The computed spectra suggest that a sensitive procedure for detecting water vapor is an examination of the 1-cm to 1.4-cm wavelength region. Author

N69-30106# Centre d'Etude Spatiale des Rayonnements, Toulouse (France).
SOUTH AMERICAN ANOMALY [L'ANOMALIE SUD-AMERICAINE]
D. A. Gagliardini [1968] 24 p
(CESR-68-108) Avail: CFSTI

At altitudes of less than 5 earth radii the radiation belts may be characterized by the two parameters B and L so long as L is not small. Some irregularities have been detected in the flux distribution in regions of the major geomagnetic anomalies. The radiation and the dynamics of the trapped particles above these regions are studied with the aid of satellite and balloon-borne measurements. Author (ESRO)

N69-30130# Deutsche Forschungsanstalt fuer Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugmechanik.
THE INFLUENCE OF THE EARTH'S OBLATENESS ON THE TRAJECTORY OF BALLISTIC BODIES [UEBER DEN EINFLUSS DER ERDABPLATTUNG AUF DIE FLUGBAHN BALLISTISCHER KOERPER]

K. Wilhelm (Ph.D. Thesis - Brunswick Univ.) Jan. 1969 133 p refs In GERMAN; ENGLISH summary
(DLR-FB-69-01) Avail: CFSTI

The motion of a body in the gravitational field of the oblate earth is investigated. The gravitational potential of the earth is assumed to be rotational symmetric and only the first term of the series expansion is considered. By introducing appropriate variables, the differential equation may be expressed in a form which allows an analytical first order treatment of the problem. The quadratures occurring can completely be expressed by elementary functions. In particular the determination of flight range of a body is treated. Furthermore, it is shown that the approximative analytical solution of the equations of motion is possible according to the method of Krylov-Bogolyubov. Comparisons with results of direct numerical integrations are made for a check of accuracy. Author (ESRO)

N69-30185# Observatoire de Paris (France).
ARTIFICIAL SATELLITES. OBSERVATIONS MADE AT BORDEAUX (1965; ECHO AND OTHERS) [SATELLITES ARTIFICIELS. OBSERVATIONS FAITES A BORDEAUX (1965 ECHO ET DIVERS)]
Paul Muller 1968 129 p In FRENCH; ENGLISH summary *Its* Publ. 21 Sponsored by CNES
Avail: CFSTI

The observations include 4109 points obtained during 525 transits. The transits are given in chronological order with the following data: hours, minutes, seconds, tenths and hundredths (universal time); azimuth (from South towards West) in degrees and minutes; elevation in degrees and minutes, corrected for refraction; right ascension in degrees and hundredths; declination in degrees and hundredths. The equatorial coordinates are referred to the equinox of the date, as was done in the former publications. Author (ESRO)

N69-30191# Finnish Meteorological Office, Helsinki.
METEOROLOGICAL YEARBOOK OF FINLAND, VOLUME 63-64, PART 4: MEASUREMENTS OF RADIATION AND BRIGHT SUNSHINE, 1963-1964 [SUOMEN METEOROLOGINEN VUOSIKIRJA, NIDE 63-64 OSA 4: SAETEILY AURINGONPAISTEHAVAINNOT 1963-1964]
1968 80 p In FINNISH and ENGLISH
Avail: CFSTI

This yearbook contains the results obtained from the observations of radiation and sunshine made at Finnish stations during the years 1963 and 1964. Radiation measurements have been made at four stations: Helsinki (Ilmala); Jokioinen; Luonetjärvi; and Sodankylä. Tables give the geographical coordinates and heights of the stations, the height at which the observing instruments were installed, and the types of observing and recording instruments in use. The position of stations at which sunshine recordings were made; their geographical positions and heights, and the use of a heating apparatus, where fitted, are shown. Author

N69-30233*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
LEAST SQUARES AND PSEUDOINVERSION
Eugene J. Lefferts 1 Sep. 1968 52 p refs
(NASA-TM-X-63570; X-551-69-73) Avail: CFSTI CSCL 22C

The purpose of postflight orbit and trajectory analysis is to establish those parameters and procedures which contribute to the uncertainty in the computed orbit. The two main techniques for postflight analyses are differential correction procedures and regression analyses. The differential correction procedure is a method by which an orbit is corrected by interatively performing a least squares fit to the differences between computed and measured observations. The actual measured quantities must be corrected as a result of station location uncertainties, bias in the data, and so on. Regression analysis is performed upon the residuals from the differential correction procedure. Models of station and measurement errors are obtained by means of a least squares fit to these residuals. Inherent in both of these procedures is the need for inverting the matrix associated with the least squares fit. In most applications these matrices tend to be poorly conditioned and the resulting inversion process becomes prone to computational errors. Thus an investigation of these errors is a prerequisite to successful postflight analyses. Author

N69-30240*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
RESONANT SATELLITE GEODESY BY HIGH SPEED ANALYSIS OF MEAN KEPLER ELEMENTS
Carl A. Wagner, Bruce C. Douglas (Wolf Res. and Develop. Corp., Riverdale, Md.) and Elise R. Fisher. Jun. 1969 21 p refs
(NASA-TM-X-63586; X-552-69-235) Avail: CFSTI CSCL 22C

A general resonant orbit and gravity constant determining program has been developed accepting short arc mean Kepler elements as data. The evolution of these elements is calculated by numerical integration of their long period and secular variations. With only slowly-changing mean element coordinates being integrated, a step size of the order of an orbit revolution or more is achieved. Satellite ephemerides over 5000 revolutions are calculated in about a minute on an IBM/360 computer. Partial derivatives of the evolved mean elements with respect to initial values and gravity constants are readily evaluated from numerically generated variant trajectories. To test the method, simulated and actual orbit data from long resonant 12-hour trajectories have been processed for gravity information by a least-squares technique. The gravity recovery is in excellent agreement with the model for the simulated data, and with previous analytic results from the actual data on Cosmos 41. Extensive data from many resonant 12- and 24-hour satellites is currently being processed by the mean element program. Preliminary determinations from these data are given. Author

N69-30266# California Inst. of Tech., Pasadena. Owens Valley Radio Observatory.
POLARIZATION MEASUREMENTS OF EXTRAGALACTIC RADIO SOURCES AT 3.12 CM WAVELENGTH, 2
G. L. Berge and G. A. Seielstad 1969 23 p refs
(Contract N00014-67-A-0094)
(AD-685251; Rept-1969-2) Avail: CFSTI CSCL 03/2

The two-element interferometer at the Owens Valley Radio Observatory was used in late 1967 to measure the integrated polarization, both linear and circular, of 32 extragalactic radio sources at a wavelength of 3.12 cm. In addition, flux densities of 103 radio sources were also measured. Author (TAB)

N69-30268# California Inst. of Tech., Pasadena. Owens Valley Radio Observatory.
A GENERAL DISCUSSION OF THE BRIGHTNESS DISTRIBUTION OF EXTRA-GALACTIC RADIO SOURCES, 3
Edward B. Fomalont 1969 52 p refs
(Contract N00014-67-A-0094)
(AD-685252; Rept-1969-3) Avail: CFSTI CSCL 03/2

The paper contains a description and discussion of the brightness distribution of extra-galactic radio sources based mainly on recent observations at the California Institute of Technology. The paper concentrates on displaying general properties of radio sources rather than a discussion of individual sources. The angular scale and the morphological types of radio structures are discussed, a method for analyzing the structure of a large sample of sources using the visibility function is outlined, and the spatial properties of the radio structure and galaxy are discussed. Author (TAB)

N69-30288*# LTV Aerospace Corp., Dallas, Tex. Missiles and Space Div.
MAJOR SOLAR AND SOLAR INDUCED PHENOMENA DURING THE 20th SOLAR CYCLE. PART 2: CONDITIONS FOR EARLY DETECTION OF SOLAR PROTON EVENTS Final Report
Fred C. Jonah 19 Jun. 1969 56 p refs
(Contract NAS9-7134)
(NASA-CR-101706; Rept-00-1192) Avail: CFSTI CSCL 03B

A summary of 43 major solar events for the years 1964 through 1968 is presented. All solar activity normally associated with the active region at the time of the flare, radio frequency emissions, or a solar proton stream is also included. Where possible, flare day solar region data, sunspot magnetic class and area, and the Carrington longitude are included. These observations were made using deep space probes and/or with maximum PCA absorption ≤2 dB, and satellites. Tables are also given. Author

N69-30282*# National Aeronautics and Space Administration, Washington, D.C.
THE LUNAR CRATERS, ACTUAL MAGNETIC FOSSILS [LES CRATERES LUNAIRES, VERITABLES FOSSILES MAGNETIQUES]
G. Carriere Jun. 1969 7 p Transl. into ENGLISH from French Presented at the Acad. des Sci. Inscriptions et Belles-Lettres and at the Soc. d'Astronomie Popular, Toulouse, 1969
(NASA-TT-F-12460) Avail: CFSTI CSCL 03B

A theory is expounded that present day lunar irregularities (craters) arose in a former era when the moon cooled, dried, and solidified. The result of this drying and solidification was thought to be manifested in actual fossils. The primitive moon was conjectured to have existed in a plasma state, possessing attributes similar to those of the sun. The evolution of this plasmatic state left magnetic craters; the processes involved in their formation are divulged. B.P.

N69-30284# Air Force Cambridge Research Labs., Bedford, Mass.
GEOPHYSICS AND SPACE DATA BULLETIN, VOLUME 8, NO. 4, FOURTH QUARTER 1968
Anne L. Carrigan and Norman J. Oliver 1968 332 p
(AD-685451) Avail: CFSTI CSCL 03/2

Contents: Total field intensity magnetometer; Cosmic ray neutron intensity monitor; Extremely low frequency noise; Riometer; Solar optical patrol observations; Solar radio emission; Vertical incidence ionospheric soundings. TAB

N69-30292*# Aztec School of Languages, Inc., Maynard, Mass.
THIRTEENTH CONFERENCE ON METEORITES [TRINADTSATAYA METEORITNAYA KONFERENTSIYA]
A. A. Yavnel Washington NASA Jun. 1969 7 p ref Transl. into ENGLISH from Priroda (Moscow), no. 1, 1969 p 108–110 Conf. held in Moscow, May 1968
(Contract NASw-1692)
(NASA-TT-F-12417) Avail: CFSTI

Fifty addresses were presented on individual problems at the 1968 annual conference on meteorites in Moscow. A brief recounting of the subjects discussed included a review lecture on advances in meteoritics. Many of the speakers investigated the results of an expedition at the site where the iron meteorite, Sikhote–Alin, fell. Several talks treated the impact of the Tunguak meteorite of 1908. The problem of studying the dust in space around the earth by optics, and rockets and satellites was also discussed. Some of the speeches considered the chemical, physical, and magnetic properties of meteorites; the origin of meteorites; and the detection of meteorites. B.P.

N69-30312*# Techtran Corp., Glen Burnie, Md.
STUDY OF THE PLANET MARS FROM 1954 - 1958 [ETUDE DE LA PLANETE MARS DE 1954 A 1958]
A. Dollfus Washington NASA Jul. 1969 56 p refs Transl. into ENGLISH from Ann. Astrophys. (Paris), v. 28, 1965 p 722–747
(Contract NASw-1695)
(NASA-TT-F-12334) Avail: CFSTI CSCL 03A

An account is given of visual, photographic, photometric, and polarimetric observations of Mars made at Pic du Midi during the 1954, 1956, and 1958 apparitions, employing observational data collected by the IAU. Studies of various Martian features (seasonal variations of surface markings, hazes and clouds, the polar caps, and the diameter and ellipticity of the planet) are described. Author

N69-30326# Lockheed Missiles and Space Co., Palo Alto, Calif.
X-RADIATION DURING GAS ACCRETION ON A NEUTRON STAR
Ia. B. Zeldóvich et al [1969] 15 p refs Transl. into ENGLISH from Astron. Zh. (USSR), v. 46, no. 2, 1969 p 225–236
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Gas accretion by a neutron star, and the spectrum of the radiation originating herewith, are considered. The whole analysis is carried out in the spherically symmetric case. A sequential, internally consistent method of computing the physical parameters of the atmosphere of a neutron star and the electromagnetic radiation spectrum is given. The computation is carried out under two assumptions on the path length of the incident protons: (1) under proton deceleration by pairwise collisions with the atmosphere's particles, and (2) taking account of collective plasma oscillations contracting the path. The radiation spectrum examined differs essentially from the Planck curve, particularly in the second case. Author

N69-30367# Defence Research Board, Ottawa (Ontario).
DEFENCE SCIENTIFIC INFORMATION SERVICE. ON THE ORIGIN OF THE LARGE LUNAR CRATERS AND CIRCULAR MARIA
G. S. Shteinberg May 1969 6 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 184, no. 3, 1969 p 568–569
(T-522-R) Avail: CFSTI

An investigation into the validity of the meteoritic hypothesis governing the formation of lunar topography is described. Extrapolations from empirical relationships used in military and engineering explosion studies, and from terrestrial crater observations were demonstrated to be in error. Two assumptions were explored with ejective explosion models and compared to experimental results. Both the depth of the explosion center and the penetration depths of iron and stony meteorites were calculated and these estimated values were not in agreement with results derived from the meteoritic hypothesis. M.H.E.

N69-30378*# Geological Survey, Washington, D.C.
ASTROGEOLOGY 13: LUNAR CRATER MORPHOLOGY AND RELATIVE AGE DETERMINATION OF LUNAR GEOLOGIC UNITS Interagency Report
H. A. Pohn and T. W. Offield Jan. 1969 37 p refs
(NASA Order R-66)
(NASA-CR-101685) Avail: CFSTI CSCL 03B

An inferred continuum of morphologic stages observed in lunar craters is described, and a numbering system to express these differences in form is proposed. More than 1,000 young lunar craters were analyzed and most were ordered into three classes on the basis of the planimetric shape of their rim crests. For simplicity, overlap was ignored and class size limits were set at 45 km, 20 to 45 km, and 8 to 20 km. Within each class, numbers

were assigned to morphological stages as an index of apparent age. Variables affecting the crater numbering system include rock strength, volcanic materials, and proximity aging. Applications in the analysis of craters and other surfaces are discussed. E.C.

N69-30390# Lockheed Missiles and Space Co., Palo Alto, Calif.
IMPORTANT STEP IN THE COGNITION OF THE UNIVERSE, SOVIET VENERA-5 AND VENERA-6 PROBES
[1969] 16 p Transl. into ENGLISH from Pravda (USSR), no. 155 (18568), 4 Jun. 1969
Avail: National Translations Center, John Crerar Library, Chicago.

A description of the trajectories, equipment, spacecraft design, and scientific experiments of the Venera 5 and 6 space probes is presented, along with a brief summary of previous observations of the planet from earth-based observatories and by earlier American and Soviet space flights. The radio altimeter data obtained from the Venera 4 mission, which left many scientific questions unanswered, led to the launching of Venera 5 and 6 to obtain simultaneous measurement of the Venusian atmospheric parameters in two different regions. A system of gas analyzers, pressure and temperature transducers, a densitometer, and photocells was successful in confirming measurements made by Venera 4 and increased the accuracy of knowledge concerning the chemical composition of the planet's atmosphere. New data were also obtained by measuring solar and galactic cosmic rays, interplanetary plasma, and scattered ultraviolet solar radiation, in addition to information on the structure of the near-planet plasma flux near Venus. A.C.R.

N69-30389# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ANALYTICAL AND NUMERICAL METHODS OF CELESTIAL MECHANICS
G. A. Chebotarev Jul. 1968 331 p refs Transl. into ENGLISH of Analit. i Chislennye Metody Nebesnoi Mekhan. (Laningrad), 1965 p 1–387
(AD-685165; FTD-HT-23-391-68) Avail: CFSTI CSCL 03/3

The stated purpose of this book is to fill a gap in the Russian-language astronomical literature, which had lacked a fundamental textbook on celestial mechanics. The treatment is limited to detailed step-by-step analysis of six methods on which present-day theories of planetary, cometary, and satellite motion are based, beginning with the differential equations and culminating in a comparison of theory with observations. These are the Laplace-Newcomb method, the Hill planetary method, the method of variation of arbitrary constants, the Hill lunar method, and the periodic-orbit and Cowell methods. Author (TAB)

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N69-29039# Sandia Corp., Albuquerque, N.Mex.
MAGNETICALLY SUSPENDED ROCKET SLED
Don Williams, Jr. Jan. 1969 11 p Sponsored by AEC
(PB-182753; SC-DC-69-1611) Avail: CFSTI CSCL 22B

The report discusses the feasibility of designing and constructing a magnetically supported test vehicle for use on atmospheric reentry tests. USGRDR

N69-29082# Aerojet-General Corp., El Monte, Calif. Space Div.
SOUNDING ROCKET VIBRATION AND DYNAMIC ANALYSES
30 Sep. 1968 224 p refs
(Contract AF 19(628)-4333)
(AD-684718; AGC-9013TR-1) Avail: CFSTI CSCL 22B

Contents: Niro vibration data; Iroquois joint analysis; Niro longitudinal vibration analysis; Niro MARS platform analysis. TAB

N69-29132*# Chrysler Corp., Huntsville, Ala. Space Div.
DYNAMIC TEST VEHICLE INTERNAL DAMPING STUDY
Richard W. Broyles 14 Dec. 1967 73 p refs
(Contract NAS8-21066)
(NASA-CR-61521; HSM-R-107-67) Avail: CFSTI CSCL 22B

The structural damping of the Saturn vehicle is determined in terms of damping characteristics of individual stages and interfaces. An analytical method was developed to compute the overall vehicle modal damping coefficients for various bending modes. This approach can also be used to obtain the modal damping of clustered arrangements knowing the individual damping characteristics of upper stages, payloads, and interfaces. Author

N69-29169# Lockheed Missiles and Space Co., Palo Alto, Calif.
INVESTIGATIONS OF OPTIMUM RENDEZVOUS MODES OF SPACE VEHICLES
Iu. G. Sikharulidze [1969] 8 p refs Transl. into ENGLISH from Kosm. Issled. (USSR), v. 7, no. 1, 1969 p 35-41
Avail: National Translations Center, John Crerar Library, Chicago, Ill. 60616

Considered is the rendezvous of a maneuverable space vehicle with a satellite. The character of the energetically optimal and the optimal fast-response rendezvous is determined for an arbitrary satellite orbit in an exact formulation of the problem. The greatest possible number of thrust switchings for a coplanar rendezvous with a satellite in circular orbit is investigated in the linearized problem. Author

N69-29348*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
SURVEYOR PROJECT PART 2: SCIENCE RESULTS Final Report
15 Jun. 1968 479 p ref
(Contract NAS7-100)
(NASA-CR-101584; JPL-TR-32-1265-Pt-2) Avail: CFSTI CSCL 22A

The results of data analysis from the various experiments conducted during the Surveyor missions are presented. Prior to a discussion of television observations made by the spacecraft, vehicle location, camera orientation, and photographic techniques are summarized. Numerous pictures were obtained of geologic formations, topography, and surface color, as well as of sunset phenomena and an eclipse of the sun by the earth. Photometric and polarimetric observations of the lunar regolith and earth functions, as viewed from the moon, were also made. Lunar surface mechanical properties and the soil mechanics of the surface sampler are described. Data were obtained on lunar surface temperature and surface electromagnetic properties, in addition to solar corona characteristics. The alpha scattering chemical analysis experiment and its results are treated in detail, followed by findings which relate to lunar theory and processes. Finally, spacecraft communications systems are discussed, including laser beam pointing tests; and a post-touchdown analysis of tracking data is given. A.C.R.

N69-29373*# Martin Marietta Corp., Denver, Colo.
USE OF SCALE MODELS TO DETERMINE THE STRUCTURAL DYNAMIC CHARACTERISTICS OF SPACE VEHICLES
Ivan J. Jeszics and A. Colton Park May 1968 181 p refs
(Contract NAS8-21456)
(NASA-CR-98479; MCR-69-103) Avail: CFSTI CSCL 22B

Because many proposed spacecraft cannot be adequately tested for dynamic characteristics in the earth environment, it is necessary to establish the feasibility of replacing the prototype configuration with an equivalent dynamic model. During this study, the applicability of dynamic scale models of future spacecraft was investigated. Two classes of spacecraft were considered: (1) the Apollo Applications Program Orbital Workshop Cluster, and (2) a hypothetical elastic reflecting space antenna. Scaling studies were performed and the optimum scale factor for each configuration was established. Dynamic model design studies were performed, and suitable fabrication techniques for each model were defined. The ground work for a proposed test program, including suspension system analysis and design, was established. The results are applicable to the definition of a complete follow-on experimental investigation. Author

N69-29422 Stanford Univ., Calif.
INVESTIGATION OF A HOPPING TRANSPORTER CONCEPT FOR LUNAR EXPLORATION
Marshall Harvey Kaplan (Ph.D. Thesis) 1968 215 p
Avail: Univ. Microfilms: HC $9.70/Microfilm $3.00 Order No. 69-239

A hopping transporter concept was conceived which incorporates both a conservative use of fuel and a high average speed. As a first step toward the practical application of such devices, an investigation of feasibility, with respect to performance capabilities, was carried out. This objective was achieved by studying the dynamic characteristics of somewhat idealized hopping vehicle configurations which are, however, based on actual conditions and mission requirements. Two schematic designs were investigated. One is a single-man device assumed to be of minimum complexity and mass, transportable with Apollo crews. The other design is a multiman transporter capable of making long range and duration explorations of the lunar surface. Both vehicles employ the technique of accelerating up a thrust-leg, locking this leg to the the main body at the end of acceleration, executing a classic ballistic parabola, and finally, decelerating down this leg to complete each hop. Dissert. Abstr.

N69-29488*# National Aeronautics and Space Administration, Washington, D.C.
MISSION REPORT: APOLLO 10
GPO 17 Jun. 1969 12 p
(NASA-EP-70; NASA-MR-4) Avail: SOD $0.35; CFSTI CSCL 22B

A brief popular account of the Apollo 10 space flight is presented. Included are photographs of the moon surface and Snoopy in lunar orbit. F.O.S.

N69-29594*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ATLAS-AGENA PERFORMANCE FOR THE 1967 MARINER VENUS MISSION
Washington Jun. 1969 109 p
(NASA-TM-X-1826) Avail: CFSTI CSCL 22B

The Atlas–Agena successfully launched a Mariner unmanned deep space probe during 1967 to fly by the planet Venus. This report discusses the performance of the Atlas–Agena from lift-off through the Agena posigrade maneuver. The objective of the mission was to extend scientific knowledge about the size and mass of Venus and the density and composition of the planet's atmosphere. Author

N69-29726*# Martin Marietta Corp., Denver, Colo.
DESIGN FEASIBILITY STUDY OF STERILE INSERTION TECHNIQUES Final Technical Report
J. C. Arnett, M. Dimitrov, J. P. Mc Donald, and A. A. Rothstein Oct. 1967 92 p refs
(Contract NASw-1621)
(NASA-CR-101632; MCR-67-340) Avail: CFSTI CSCL 22B

The objective was to develop a number of design concepts for sterile insertion. These concepts use heat sealing of plastic films to permit aseptic penetration of a container with a sterilized interior. The study had two major portions: one was devoted to the development of the design concepts for the sterilization canister entry port, the service bag, and the heat-sealing and cutting tools; the second was devoted to the materials evaluation and selection of the plastic film for use as the barrier over the entry port. As a result of this study, six feasible design concepts for sterilization-canister entry ports, with corresponding service bags and service-bag mounting methods, were conceived. Three concepts used external plastic barriers; three (including the final recommended design) employ internal plastic barriers. In addition, four designs for heat-sealing tools and five designs for cutting tools were evolved. Author

N69-29850*# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE AUTOMATIC STATION "ZOND-5" FLEW AROUND THE MOON AND RETURNED TO THE EARTH
A. Dmitriev 11 Oct. 1968 13 p Transl. into ENGLISH from Krasnaya Zvezda (Moscow), no. 225, 1968 p 1
(AD-685485; FTD-HT-23-952-68) Avail: CFSTI CSCL 22/2

A brief recapitulation is given of the previous space exploration building up to the flight of the Zond-5, which was the first space station to go into the region of the moon and return. Author (TAB)

N69-29864*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
ISIS-A SPACECRAFT MAGNETIC TESTS
J. C. Boyle Mar. 1969 33 p refs
(NASA-TM-X-63584; X-325-69-105) Avail: CFSTI CSCL 22B

The ISIS-A spacecraft was tested in the GSFC Attitude Control Test Facility. In the initial series of tests the spacecraft, as received, had a perm moment of 388 pole cm which was reduced by deperm treatment to a final value of 203 pole cm. A maximum moment of 578 pole cm occurred during stray power testing. The maximum induced moment was 356 pole cm, when a field of 0.3 gauss was applied +x direction. The magnetic moment of the torquing coils was measured both by magnetometer and torquemeter to be about 140,000 pole cm both statically and dynamically. Gating thresholds and sense of moment were proper. In addition, all onboard magnetometers were satisfactorily calibrated. In the final series of tests the perm moment as received was 3295 pole cm, mostly along the z axis. This was reduced by deperm treatment to 681 pole cm as a final value. Rechecks were made of the spin and attitude control system as well as final calibration of the magnetometers. All results fell within the specification limits. Author

N69-29876# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
DODGE SATELLITE PERFORMANCE, 1 JULY 1967–1 OCTOBER, 1968 VOLUME A
Dec. 1968 416 p refs
(Contract NOW-62-0604-c)
(AD-685218; APL-TG-1034A-Vol-A) Avail: CFSTI CSCL 22/2

In Volume A of this report the mission of the Department of Defense Gravity Experiment (DODGE) satellite program is defined, the design of each of the satellite systems is briefly described, and

the performance of each of the systems from the time the satellite was launched into orbit on 1 July 1967 to 1 October 1968 is described in detail. The systems include attitude control, attitude detection, electric power, telemetry, command, thermal control, and doppler tracking. It also includes ground station operations. The report summarizes the magnetic field measurements made to date and the performance of the satellites attitude control systems. It presents conclusions on the attitude performance and on how well the objectives of the mission were met. Author (TAB)

N69-29877# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
DODGE SATELLITE PERFORMANCE, 1 JULY 1967–1 OCTOBER 1968. VOLUME B: APPENDIX
Dec. 1968 151 p refs
(Contract NOW-62-0604)
(AD-685219-APL-TG-1034B-Vol-B) Avail: CFSTI CSCL 22/2

The volume contains pitch-roll, yaw, and in-plane-cross-plane plots for APL passes 2 through 39 and ORRORAL passes 2, 9, 14, 16, and 17. Author (TAB)

N69-29894# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FROM TAKEOFF TO LANDING
D. Nadezhdin and V. E. Ivanov Jul. 1968 10 p Transl. into ENGLISH of Krasnaya Zvezda (Moscow), 19 Oct. 1967 2 p
(AD-684995; FTD-HT-23-397-68) Avail: CFSTI CSCL 22/2

The report covers the launch at 0539 44.7, 12 June 1967, the 128 day flight, and the descent to the surface of Venus on 18 October 1967 of the Automatic interplanetary station Venus-4 and of some of the events leading up to the successful completion of the spacecrafts mission. A short general description of the spacecraft and on-board equipment is included. TAB

N69-30101# Hawker Siddeley Dynamics, Ltd., Stevenage (England). Space Projects Div.
A PRELIMINARY PROJECT STUDY OF EUROPA 3
C. E. Allen, comp. Jan. 1969 407 p refs Sponsored by ELDO
(HSD-TP-7151) Copyright. Avail: Hawker Siddeley Dyn., Hatfield

This report deals with an ELDO launch vehicle with a payload capacity of more than 500 kg to be launched from French Guiana into a stationary orbit. Europa 3 will consist of a Blue Streak vehicle with one 14 ton liquid hydrogen propelled upper stage. Injection of a payload into synchronous orbit can be carried out in various ways: e.g. with perigee and/or apogee motors. ESRO

N69-30209# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OPTIMUM CONTROL DURING ENTRY INTO THE ATMOSPHERE
D. E. Okhotsimskii et al Nov. 1968 38 p Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 6, no. 1, 1968 p 31–48
(AD-685064; FTD-MT-24-372-68) Avail: CFSTI CSCL 22/3

The problem of controlling the descent of a spacecraft into the atmosphere at speeds on the order of escape velocity is investigated. It is assumed that control is carried out by changing the roll angle. The requirements are discussed for a descent control system. Two control algorithms are described, the basis of which is the concept of optimum use of measuring and a priori information. The effectiveness of the application of several adaptation methods is investigated. The results of calculations are given. Author (TAB)

N69-30232*# National Aeronautics and Space Administration, Goddard Space Flight Center, Greenbelt, Md.
APOLLO NAVIGATION, GROUND AND ONBOARD CAPABILITIES
F. O. Vonbun and John P. Mayer (NASA, Manned Spacecraft Center) 1 Sep. 1965 189 p refs
(NASA-TM-X-61720; TR-65-AN-2.0) Avail: CFSTI CSCL 22B

The results of ground network navigation studies are given. The lunar mission has been divided into seven consecutive phases, each of which has been analyzed under conservative assumptions. The results, therefore, are conservative compared with the results of an analysis of a continuous mission. Note that the results are given in 3σ values. The analysis was based on a ground tracking network performance. Author

N69-30330*# National Aeronautics and Space Administration, Electronics Research Center, Cambridge, Mass.
SPACECRAFT MAGNETIC TORQUES
Mar. 1969 55 p refs
(NASA-SP-8018) Avail: CFSTI CSCL 22B

The magnetic torque resulting from the interaction between the magnetic properties of a spacecraft and the ambient magnetic field is studied in the light of magnetic disturbance torque considered in the determination of spacecraft attitude motion, control actuator sizing, expendable fuel requirements, and spin decay. The two design criteria associated with magnetic disturbance torques are: (1) assessment of the magnitude of the torque; and (2) control over the spacecraft magnetic characteristics during design and development to assure achievement of an acceptably low magnetic disturbance torque. F.O.S.

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N69-29150*# Techtran Corp., Glen Burnie, Md.
SYMMETRICAL DEFORMATION OF A NEARLY CYLINDRICAL SHELL
Ye. F. Burmistrov Washington NASA Jun. 1969 17 p refs Transl. into ENGLISH from Prikl. Mat. i Mekh. (Moscow), v. 13, no. 4, 1949 p 401–412
(Contract NASw-1695)
(NASA-TT-F-12217) Avail: CFSTI CSCL 20K

Symmetrical deformation was investigated in a nearly cylindrical orthotropic shell under the effect of a load applied both to the side surface and to the edges. The problems related to the symmetrical deformation of an orthotropic shell whose meridian represents the arc of a parabola were also examined. The solution was found by the method of small parameters, which is often used for investigating deformations of rods and plates and leads to calculation formulas which consider second approximation. The solution for an isotropic shell of the same shape can be found as the partial case. Author

N69-29159*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
CRITICAL-SPEED ANALYSIS OF RIGID ROTORS ON FLEXIBLE FOUNDATIONS
Richard H. Cavicchi Washington Jun. 1969 48 p refs
(NASA-TN-D-4858) Avail: CFSTI CSCL 01A

A critical-speed analysis of undamped rigid rotors on flexible foundations reveals four conical-mode solutions comprising forward and backward precession. There is also a two-solution

bouncing-mode set dependent only on foundation-to-rotor mass and spring-constant ratios. Although analysis of a firm foundation model omits two of the four conical-mode solutions, good agreement exists between the two corresponding solutions. The flexible-foundation analysis can be approximated by a simple firm-foundation result when the foundation-to-rotor spring-constant ratio is zero or infinite. Only three calculations are needed in this range to cover all intermediate values. Author

N69-29193 Illinois Univ., Urbana.
ON ISOTENSOID FIBER-WOUND SURFACES OF REVOLUTION
Allister Francis Fraser (Ph.D. Thesis) 1968 142 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 69-1343

The analysis and design of isotensoid axisymmetric membranes has been broadened to include treatment of problems where surface shape and loading are specified. The surface loads considered may be nonuniform and may have components tangent to the surface but are restricted to lie in meridional planes. This is accomplished by two methods. In the first, the analysis accounts for matrix shear loads with the result that isotensoid solution to prescribe shape problems is accomplished with as little as two fiber layers. In the second method, a continuous distribution of fiber angles at each point in the surface is assumed. This allows determination of the isotensoid fiber pattern for fixed shape problems without the use of matrix shear loads. A general solution is obtained and an approximate method is developed to handle difficult analytic problems. Dissert. Abstr.

N69-29228* Boeing Co., Seattle, Wash. Office of International Operations.
A METHOD FOR OBTAINING LONG-TERM CREEP CHARACTERISTICS FROM SHORT-DURATION RELAXATION TESTS
Jean Lemaitre Jan. 1969 20 p refs Transl. into ENGLISH from French Presented at 5th Inter. Rheol. Congr., Kyoto, 7–11 Oct. 1968
(F-253) Avail: CFSTI

Creep calculations of metallic structures with long lifetimes (several years) are made most frequently on the basis of experimental data obtained in brief so-called extrapolation methods. A new method based on the existence of a law of behavior would make it possible to avoid using simulation parameters. It is based on the principle of using rheologic states defined by relaxation tests to restore the creep curves through the state parameters. The considerable time gain achieved is related to the strongly non-linear character of visco-plastic materials. A certain number of results were obtained on rheologically stable materials in a range of plastic deformation velocities with a lower bound of 10^{-6} s^{-1}. The method is being expanded further by constructing a multiple relaxation device built for the purpose of reaching the velocities which would answer actual needs in the industry. Author

N69-29305 Stanford Univ., Calif.
STABILITY AND DYNAMICS OF CONICAL SHELLS
Dror Bendavid (Ph.D. Thesis) 1968 163 p
Avail: Univ. Microfilms: HC $7.60/Microfilm $3.00 Order No. 69-193

The thermal buckling of a conical shell heated along a generator was analyzed by a Rayleigh–Ritz approach in conjunction with displacement functions modified by a shape factor. A two term solution is presented in detail and numerical results are correlated with a typical experiment. The results of an experimental investigation on the instability of thin truncated conical shells of large taper ratio under hydrostatic pressure are discussed and correlated with theory. The test results remove doubts about the validity of the theories of Seide and Singer for cones of large taper ratio. Equations of motion and associated boundary conditions are developed for the general nonlinear vibrational behavior of thin conical shells. The theory is based upon nonlinear strain-displacement relations deduced for a conical shell from those derived by Sanders for thin shells of compound curvature. Dissert. Abstr.

N69-29309 Illinois Univ., Urbana.
AN ANALYSIS OF CIRCULAR CYLINDRICAL SHELLS SURROUNDED BY AN ELASTIC FOUNDATION
Bruce Mitchell Cowan (Ph.D. Thesis) 1968 129 p
Avail: Univ. Microfilms: HC $6.20/Microfilm $3.00 Order No. 69-1322

A method is presented for analyzing circular cylindrical shells surrounded by a continuum of material such as rock or soil. The method requires neither that the applied loads be circumferentially uniform nor that the surrounding continuum have uniform properties, either circumferentially or along the axis of the shell. These features are desirable in any method that is used to analyze vertical shafts in the ground which may be subjected to unsymmetrical loads. A missile silo is a good example of such a structure. The cylinder is treated as a thin shell, and the surrounding continuum is treated as an elastic foundation. The foundation is not allowed to pull against the cylinder wall, and an elastic-plastic stress-strain curve is assumed for the springs which represent the foundation. The base of the cylinder is considered to be either fixed or hinged. The top of the cylinder is considered to be either free or covered with a heavy slab which permits only rigid body motion. Dissert. Abstr.

N69-29310 Illinois Univ., Urbana.
FREE AND FORCED VIBRATIONS OF HYPERBOLOIDAL SHELLS OF REVOLUTION
Robert Leon Carter (Ph.D. Thesis) 1968 140 p
Avail: Univ. Microfilms: HC $6.60/Microfilm $3.00 Order No. 69-1312

A theoretical study is made of the free and forced vibrations of hyperboloidal shells of revolution. The problem is formulated for an arbitrary thin shell of revolution of which the hyperpoloid is considered as a special case. The general problem is coded for an IBM 7094 digital computer. The boundary conditions considered are for a shell which is free at one edge and clamped at the other although the modal method analysis may be used for other boundary conditions. It is assumed that the material of the shell is linearly elastic and homogeneous. The investigation is restricted to small strains and displacements. Both a generalization of the Holzer method and an asymptotic method are used to determine the mode shapes and natural frequencies. The results of the two methods are compared with known solutions and experimental results for cones and cylinders. It is shown that the Holzer method yields excellent results, but some difficulties are encountered with the asymptotic method which restrict its usefulness. Dissert. Abstr.

N69-29335 Alabama Univ., University.
BENDING AND BUCKLING OF ORTHOTROPIC AND ISOTROPIC CONICAL SHELLS
Han Yun Chu (Ph.D. Thesis) 1968 85 p
Avail: Univ. Microfilms: HC $4.40/Microfilm $3.00 Order No. 68-15478

The structural response of bending and buckling of thin conical shells of constant thickness is studied. The bending of orthotropic conical shells subjected to three types of load: (1) lateral normal loads; (2) thermal loads, and (3) an axial load combined with internal pressure are investigated by means of the asymptotic

method. For the first two types of load, asymptotic solutions for asymmetrical cases are presented. Numerical examples are given for a ring-stiffened semicircular cone which is simply supported along two generators with one end fixed and the other end free. For the third type of load, the axisymmetrical cases are considered. Numerical examples are given for the ring-stiffened cone frustums with both ends simply supported or both ends clamped. The buckling strength of an isotropic cone frustum subjected to an axial concentrated compressive load is investigated. Both membrane and lateral deformations are taken into consideration for the prebuckling state. Dissert. Abstr.

N69-29350 California Univ., San Diego.
FINITE DIFFERENCE METHODS IN ELASTICITY WITH HIGH DEGREES OF PRECISION
Jay William Feldmann (Ph.D. Thesis) 1968 120 p
Avail: Univ. Microfilms: HC $5.80/Microfilm $3.00 Order No. 68-15681

The development of some techniques for the numerical solution to boundary value problems of two-dimensional elasticity is discussed. Chapter 1 is concerned with the numerical determination of the displacement field in an elastic disk under stress boundary conditions. A method of establishing consistent finite difference equations is presented. Chapter 2 deals with the stresses in the torsion problem, and Chapter 3 with the stresses in two-dimensional problems of elasticity with mixed boundary conditions. The torsion problems for the square and the equilateral triangle are treated as examples illustrating the technique. First order and higher order analyses are presented, and it is shown that the higher order analysis may improve results significantly. Finally, the new technique is shown to be equivalent to a sophisticated finite difference technique. The new technique uses the first derivatives of the displacement components at the grid points as unknowns. Its application to mixed boundary value problems is illustrated by examples using first order or higher order analyses. Dissert. Abstr.

N69-29351 Pennsylvania Univ., Philadelphia.
A MICROSTRAIN INVESTIGATION OF POLYETHYLENE
Stephen Rabinowitz (Ph.D. Thesis) 1968 350 p
Avail: Univ. Microfilms: HC $15.75/Microfilm $4.50 Order No. 69-158

The small strain mechanical behavior of linear polyethylene has been investigated using an extensometer operating at strain resolutions on the order of 10^{-7}. With such strain resolution it was sought to evaluate the nature of the crystalline contribution to the total deformation of the spherulitic polyethylene, and, wherever possible to quantitatively assess the extent of such crystalline compliance. The investigation was carried out in two temperature regions. In the vicinity of room temperature, such parameters of the material compliance as Young's modulus, the deviation in strain from ideal linear elastic behavior, and the energy dissipated in a load–unload deformation cycle, were observed in their dependence on strain rate (from 10^{-6} to 10^{-4} sec^{-1}), temperature (from 17°C to 28°C), direction of loading (tension and compression), and irradiation dose (5 mrads and 80 mrads), over the range of stress amplitudes 19 to 50 psi. Dissert. Abstr.

N69-29355 Polytechnic Inst. of Brooklyn, N.Y.
AXISYMMETRIC ELASTICITY SOLUTIONS OF SPHERICAL SHELL SEGMENTS
Howard Stanley Levine (Ph.D. Thesis) 1968 88 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 68-16254

No exact solution for the spherical segment problem has been reported on in the literature, and, because of the importance of this problem the present study has been undertaken. By combining two sets of functions, namely, homogeneous functions and full sphere functions, a whole series of axisymmetric spherical segment problems is solved. Solutions to the following problems are obtained: (a) the spherical segment with a stress-free edge subjected to a centrifugal force field; (b) the hemisphere having zero traction on its spherical surfaces subjected to edge shear stresses and having vanishing longitudinal displacements or direct stresses on its edge; (c) the spherical segment subjected to an external pressure supported on a rigid surface with no shear resistance. It should be pointed out that these results yield exact solutions to problems which have been heretofore investigated only by using shell theory approximations. Dissert. Abstr.

N69-29364 Lehigh Univ., Bethlehem, Pa.
AN INVESTIGATION OF FATIGUE CRACK PROPAGATION IN THIN CYCLINDRICAL SHELLS CONTAINING AN INCLINED CRACK
Fred Jack Fisch (Ph.D. Thesis) 1968 157 p
Avail: Univ. Microfilms: HC $7.40/Microfilm $3.00 Order No. 68-15900

An experimental investigation was conducted to determine fatigue crack growth rates for inclined cracks in thin cylindrical shells of 6063-T6 aluminium under reversed cyclic torsion. Existing fatigue crack growth models for flat plates loaded in tension and bending were extended to include combined tension and bending. The combined model was then used to analyze the experimental results. The combined load crack growth model employs the crack tip stress intensity factor as the correlating parameter. Analysis of the crack growth data indicates that the approximate stress intensity factor is a useful correlating parameter over the limited range of data obtained from the experiments. It was noted, however, that the material constants obtained from the correlation are not in complete agreement with those obtained from flat plate tests of other aluminum alloys. Dissert. Abstr.

N69-29406 Minnesota Univ., Minneapolis.
CERTAIN ASPECTS OF SEGREGATION EFFECTS IN PARTICULATE SOLID SYSTEMS
James Robert Johnson (Ph.D. Thesis) 1968 109 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 68-17739

Some basic phenomena involved in the segregation of particulate solids in response to well defined and carefully controlled modes of agitation were studied. Two universally encountered modes of agitation were selected: vertical vibratory agitation and shear. Idealized systems of steel spheres, shaped particles, and steel shot were studied. Measurements were made of the segregation behavior of such systems in which the particles were coated with various materials so as to alter their surface characteristics. Coating materials included rosin, magnesium stearate, and silicone oils. It was concluded that segregation of particulate solids generally occurs by the same basic mechanism, regardless of the mode of agitation, which involves competition of the particles for interparticulate void space. Segregation proceeds as a result of differences in the abilities of particles within a given system to move into these voids. Particulate variables are of demonstrated importance, both in controlling the generation of voids and in influencing particle mobility. Dissert. Abstr.

N69-29408 Pennsylvania Univ., Philadelphia.
FEEDBACK CONTROL OF THE BUCKLING INSTABILITY IN AN AXIALLY COMPRESSED THIN ELASTIC BEAM
Raymond Palmer Jefferis, III (Ph.D. Thesis) 1968 126 p
Avail: Univ. Microfilms: HC $8.00/Microfilm $3.00 Order No. 69-124

A thin elastic beam in axial compression is shown, to be a statically unstable system when the longitudinal compressive force exceeds a critical value determined by the beam characteristics and boundary conditions. The consequent buckling instability may be averted by applying a controlled transverse restoring force, spatially distributed over the beam surface, proportional to the beam displacement. This linear distributed parameter control problem is formulated as a Fredholm integral equation of the second kind. The Green's function kernel is then expanded in a truncated Fourier series of normal vibratory modes, and the resulting approximate solution obtained by the Galerkin method yields the critical control loop gain. Applications suggested include controlled stabilization of moving steel sheet in rolling mills, vibrating aerodynamic surfaces, neutron flux density, fluid jets, and other unstable distributed systems. Dissert. Abstr.

N69-29428 Washington Univ., Seattle.
WAVE PROPAGATION AND DYNAMIC STRESS ANALYSIS OF A VISCOELASTIC CYLINDER
Suryanarayana Rao Varanasi (Ph.D. Thesis) 1968 154 p
Avail: Univ. Microfilms: HC $7.20/Microfilm $3.00 Order No. 69-1222

The problem of radial wave propagation for an infinitely long, hollow viscoelastic cylinder subjected to an internal pressure is considered. The problem is formulated in terms of the radial displacement for a linearly viscoelastic material with a constant Poisson's ratio but otherwise general viscoelastic behavior. The solution is obtained by the method of integral transforms: finite Hankel transform with respect to the radial coordinate and Laplace transform with respect to time. This method gives the solution in the form of an infinite series. The Hankel transform reduces the problem to the solution of a sequence of Volterra integral equations. These integral equations can be solved by Laplace transform technique for a viscoelastic material whose relaxation modulus is expressed as a Prony series. The techniques of summation of the series to obtain the solution at any point in the cylinder and at any time are discussed. Dissert. Abstr.

N69-29474# Polytechnic Inst. of Brooklyn, N.Y. Dept. of Aerospace Engineering and Applied Mechanics.
ASYMMETRIC NATURAL VIBRATIONS OF ORTHOTROPIC CIRCULAR PLATES OF VARIABLE THICKNESS
Alan P. Salzman and Sharad A. Patel Mar. 1969 24 p refs
(Contract Nonr-839(40))
(AD-685256; PIBAL-69-6) Avail: CFSTI CSCL 13/13

Natural frequencies corresponding to asymmetric modes of vibration of orthotropic circular plates with variable thickness were investigated. The governing differential equation is solved by the method of separation of variables together with Frobenius method. The characteristic equations for the natural frequencies of clamped and simply supported plates are derived. Numerical values of frequencies corresponding to several modes of vibrations are presented for various particular plate shapes. Author (TAB)

N69-29568*# Dynatech Corp., Cambridge, Mass.
ASYMMETRIC NONLINEAR DYNAMIC RESPONSE AND BUCKLING OF SHALLOW SPHERICAL SHELLS
Atis A. Liepins Washington NASA Jun. 1969 83 p refs
(Contract NAS1-6586)
(NASA-CR-1376) Avail: CFSTI CSCL 20K

A numerical method and computer program are developed for the computation of the large deflection dynamic response of simply supported shallow spherical shells subjected to a class of spatially asymmetric and timewise step loadings. The numerical method employs two dimensional spatial finite differences, timewise finite differences together with Houbolt's method, and solution by Newton's procedure together with an extension of Potters method. Response histories and asymmetric dynamic buckling loads for several geometries and load durations are presented. Author

N69-29584* Boeing Co., Seattle, Wash. Space Div.
DESIGN AND DEVELOPMENT OF TECHNIQUES FOR FABRICATION OF CRYOGENIC TANK SUPPORT STRUCTURES FOR LONG TERM STORAGE IN SPACE FLIGHTS, PHASE 1, 1 APRIL–1 NOVEMBER 1968
16 Jan. 1969 82 p refs
(Contract NAS8-20901)
(NASA-CR-98489) Avail: CFSTI CSCL 20K

The least weight method of constructing a conical support for the 32 ft diameter modular nuclear vehicle LH_2 tank is discussed. Both metallic and nonmetallic materials were considered as well as various methods of construction, i.e., honeycomb sandwich, stiffened skin, and corrugations. Initial effort consisted of optimizing various construction methods to yield a structure of minimum cross sectional area. Detail designs of the optimized structural concepts were then developed and a weights analysis was made. Thermal conductance was calculated and, in turn, was used to determine LH_2 boil-off losses for a specific mission duration. The summation of LH_2 boil-off weight and structural support weight provided a means of comparing concept efficiency. Fiber glass honeycomb sandwich construction was shown to be the most efficient for the tank support. Author

N69-29589*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
ON THE PHENOMENON OF THERMOELASTIC INSTABILITY (THERMAL FLUTTER) OF BOOMS WITH OPEN CROSS SECTION
Richard M. Beam Washington Jun. 1969 19 p refs
(NASA-TN-D-5222) Avail: CFSTI CSCL 13M

Laboratory experiments performed to demonstrate the phenomenon of thermoelastic flutter of booms with open cross section are described. The problem of torsional instability is chosen for theoretical treatment and comparison with quantitative experimental results. The theoretical and experimental models show: (1) One-degree-of-freedom torsional thermoelastic flutter is possible and predictable. (2) Thermoelastic coupling can stabilize as well as destabilize a system. (3) Small amplitude linear theory can predict thermoelastic instability. Author

N69-29607*# National Aeronautics and Space Administration. Langley Research Station, Langley Station, Va.
FATIGUE OF NOTCHED Ti-8Al-1Mo-1V TITANIUM ALLOY AT ROOM TEMPERATURE AND 560 DEG F (560 DEG K) WITH FLIGHT-BY-FLIGHT LOADING REPRESENTATIVE OF A SUPERSONIC TRANSPORT
L. A. Imig and Walter Illg Washington Jul. 1969 44 p refs
(NASA-TN-D-5294) Avail: CFSTI CSCL 20K

Fatigue studies were conducted on notched sheet specimens of Ti–8Al–1Mo–1V titanium alloy. The effects of loading parameters and elevated temperature on fatigue life were investigated in variable-amplitude tests that simulated flight loading of a supersonic transport operating at a Mach number of 3. Test stresses were applied flight by flight either at room temperature or at 550°F (560°K). Test results indicated a strong influence of design mean stress, the ground-air-ground cycle, and elevated temperature. Effects due to simulated taxi stresses and thermal stresses were observed to be small. A series of constant-amplitude tests on the same type of specimen that was used in the variable-amplitude tests was conducted to provide data for a linear cumulative-damage analysis. Author

N69-29624# Naval Research Lab., Washington, D.C.
THE STATIC EQUILIBRIUM CONFIGURATION OF CABLE ARRAYS BY USE OF THE METHOD OF IMAGINARY REACTIONS Interim Report
Richard A. Skop and George J. O'Hara 28 Feb. 1969 38 p refs
(AD-685195; NRL-6819) Avail: CFSTI CSCL 13/10

A new technique, The Method of Imaginary Reactions, is introduced for determining the static equilibrium configuration of cable arrays. Throughout this technique, a discrete parameter representation of the system is employed. However, it should be noted that the analysis method used depends only on the number of redundant reactions encountered; thus, the system can be represented with arbitrary fineness without increasing the complexity of the problem. An iterative solution is generated for varying the unknown reactions, and convergence to the correct equilibrium configuration of the array is guaranteed. The rapidity of convergence is shown by several numerical examples. The solution for the case of position-dependent applied external forces is indicated.
Author (TAB)

N69-29635# Brown Univ., Providence, R.I. Div. of Engineering.
STUDIES ON THE DYNAMIC BEHAVIOR OF RIGID-PLASTIC STRUCTURES
Guiliano Augusti Feb. 1969 86 p refs
(Contract ARPA SD-86)
(AD-685279; ARPA-E63) Avail: CFSTI CSCL 13/13

The study of which the report presents the first results, was undertaken with a view of eventually filling this gap and furnishing procedures for the dynamic analysis of plastic structure under any loading history. Therefore, rather than solving particular problems, the attention is focused on recognizing general characteristics, outlining avenues of approach, and so on. A substantial portion of the report deals in particular with periodic loading of structures which behave symmetrically with respect to the sign of the loads; it is possible to derive some rather general results on the rigid-plastic response in this case, without any qualifications of the structural type. However, the symmetry assumptions are particularly realistic in the case of rectangular frames subjected to horizontal loads, and specific results pertaining to these structures are also presented, including multi-degree of freedom response.
Author (TAB)

N69-29664# Delaware Univ., Newark. Dept. of Mechanical and Aerospace Engineering.
NONCIRCULAR CYLINDRICAL SHELLS OF PYROLYTIC GRAPHITE TYPE MATERIALS
R. Daugherty (NSF) and J. R. Vinson Nov. 1968 41 p refs
(Grants NSF GK-684; NSF-3878)
(TR-95) Avail: Issuing Activity

A formulation of the governing equations for shells of arbitrary shape of transversely isotropic materials accounting for thermal strains across the shell thickness and transverse shear deformation is presented. This set of equations is then solved for the case of a noncircular cylinder using an asymptotic expansion procedure. The method uses two asymptotic series, which combined with the particular solutions, give the total solution. The final form of the solution presented contains the arbitrary functions to be determined from the boundary conditions. The solution for the special case of a shell of isotropic material is also given.
Author

N69-29672*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THE CALCULATION OF ELEVATED TEMPERATURE CYCLIC LIFE CONSIDERING LOW CYCLE FATIGUE AND CREEP
David A. Spera Washington Jul. 1969 25 p refs
(NASA-TN-D-5317) Avail: CFSTI CSCL 20K

A general method is presented for calculating the cyclic life of a material subjected to isothermal stress- or strain-cycling at temperatures which may be in the creep range. Failure is assumed to be caused either by the accumulation of creep damage or by conventional, time-independent fatigue. A modification of the life-fraction rule and the method of universal slopes are used to calculate creep and fatigue lives, respectively. The method of cyclic life analysis is evaluated by using data on four high temperature alloys. Calculated and observed lives are in good agreement.
Author

N69-29734*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ANALYSIS OF DYNAMIC JETTISON HINGE FORCES FOR CENTAUR NOSE FAIRING
Hsin Ming Tang Washington Jul. 1969 30 p refs
(NASA-TM-X-1821) Avail: CFSTI CSCL 20K

Dynamic loads on nose fairing hinges are determined by a combination of tests and analyses. Transfer-function techniques are used. Hinge-force evaluations are determined according to normal mode theory for three-directional motion making use of data from tests of a fairing in a free–free end condition. A parametric study is presented of the hinge forces due to rigid body motion alone and combined motions of the rigid body and elastic modes.
Author

N69-29745# North Carolina State Univ., Raleigh.
POWER ACCELERATOR SYSTEMS FOR AXIAL IMPACT STUDIES
J. K. Whitefield, R. A. Douglas, and S. Jealani Feb. 1969 28 p refs
(Contract N00014-68-A-0187; ARPA Order 1080)
(AD-685245; TR-69-3) Avail: CFSTI CSCL 20/11

Report describes 16 mm, 19 mm, and 50 mm powder gun systems used to accelerate slender cylindrical specimens to velocities of several thousand feet per second for axial impact with identical target specimens. The accelerators described are fired charge powder guns with long smoothbore vented barrels, mounted for free recoil and with integral target chambers and catches. The systems operate with vacuum and create constant velocity impact conditions.
Author (TAB)

N69-29748# New York Univ., N.Y. Courant Inst. of Mathematical Sciences.
STRESSES IN CANTILEVER PLATES
Frances Bauer and Edward L. Reiss Feb. 1969 39 p refs
(Contracts Nonr-285(42); AT(30-1)-1480)
(AD-685274; IMM-374; NYO-1480-111) Avail: CFSTI CSCL 13/13

A numerical method is presented for determining the bending stresses in elastic cantilever plates. Southwells formulation of the classical small deflection plate theory is employed. The method is applied to obtain numerical solutions for rectangular and swept back plates subjected to a variety of surface and edge loads. Boundary layer effects are observed for the uniformly loaded rectangular plates as the length of the plate decreases. The effects of a load concentration and sweep back are observed and summarized in the form of stress concentration factors.
Author (TAB)

N69-29754# Department of Supply, Melbourne (Australia). Aeronautical Research Labs.
A TWO-PHASE DAMAGE THEORY FOR LIFE DISTRIBUTION PREDICTION

M. J. O'Neill Oct. 1968 31 p refs
(ARL/SM-322) Avail: CFSTI

A two-phase damage accumulation hypothesis is proposed to explain some features of the results obtained in rotating bending tests on a high strength aluminum alloy. The results of life calculations using this hypothesis are presented and compared with the observed lives and with Miner rule predictions for a number of step tests and one program test. The two-phase rule appears generally superior to the Miner rule but at some expense in computation and with the added complexity of requiring cycles in each phase rather than total cycles to failure at each stress condition. Some of the tests show a coaxing effect, a phenomenon which is not predicted by the damage hypothesis in its present form. Author

N69-29778# North Carolina State Univ., Raleigh.
GENERAL OPTICAL DIFFRACTION-STRAIN RELATIONS
H. W. Bieka, H. H. Stadelmaier, and R. A. Douglas Mar. 1969 Mar. 1969 55 p refs
(Contract N00014-68-A-0187; ARPA Order 1090)
(AD-685244; TR-69-2) Avail: CFSTI CSCL 20/11

General diffraction-strain equations are developed for the optical diffraction grating strain gages now coming into use in connection with experimental studies of wave propagation in solids. Equations are derived for the following cases: superimposed gratings crossed at any angle and subjected to arbitrary surface strains; orthogonal gratings subjected to arbitrary rotations; and orthogonal gratings aligned with principal strain directions and subjected to arbitrary rotations during the strain. The inherent strain resolution capability of an optical diffraction system is discussed and the differences between this technique for strain measurement and that of x-ray stress analysis are described. Author (TAB)

N69-29823# Technisch Physische Dienst TNO-TH, Delft (Netherlands).
EVALUATION OF THE TENDENCY TO FRACTURE IN MATERIAL UNDERGOING IMPULSIVE LOADING USING SMALL SPECIMENS
A. C. Van Elst *In* EURATOM Shock Struct. Interactions in Reactor Vessels Oct. 1968 p 193–210 refs (See N69-29815 16-22)
Avail: CFSTI

A technique for submitting small specimens to stress time pulses, artificially generated in a pressure bar, is described along with methods of estimating the resultant brittleness of the materials. Energy-absorption-versus-temperature curves are given for several varieties of steel in delivery condition and after increasing neutron radiation fluence, as deduced from recordings in stress wave attenuation tests. Dynamic stress–strain diagrams, derived from testing, often indicated a considerable increase in Young's modulus and an increase in plastic deformation when stress decrease occurred. This effect was stronger with aluminum than with steel and became more pronounced at higher temperatures. Also, the observed jump in the energy-absorption-versus-temperature curve at transition in the stress wave attenuation test was much smaller than with notch impact tests, apparently due to the fact that the deformation is not proceeded by fracture, as in the usual destructive tests. Finally, it was noted that a decrease in energy absorption in the ductile region resulted in embrittlement. A.C.R.

N69-29825# Naval Research Lab., Washington, D.C.
EFFECT OF STRAIN RATE ON FRACTURE STRENGTH OF CONVENTIONAL STRUCTURAL STEELS
W. S. Pellini *In* EURATOM Shock Struct. Interactions in Reactor Vessels Oct. 1968 p 217–220 refs (See N69-29815 16-22)
Avail: CFSTI

In a brief analysis of the fracture toughness of structural steels, it is emphasized that realistic analyses of the effects of dynamic loading on material response must include the assumption that defects may be present, and an acceptance of the fact that these defects, such as notches and cracks, have been proven to decrease fracture resistance to low levels under certain conditions. Particular attention is paid to the effect of temperature on fracture propagation. Three sources of fracture initiation, which result in dynamic loading conditions are also listed, as well as mention of the importance of flaw size and stress relationships in addition to purely dynamic effects. A.C.R.

N69-29827# European Atomic Energy Community, Ispra (Italy).
THE RESPONSE OF A VESSEL TO AN INTERNAL BLAST LOADING: LIMITS OF MODEL TESTS INFLUENCE OF STRAIN-RATE
H. Holtbecker, A. Maserati, M. Montagnani, and G. Verzeletti *In its* Shock Struct. Interactions in Reactor Vessels Oct. 1968 p 251–304 refs (See N69-29815 16-22)
Avail: CFSTI

The use of explosives to adequately simulate blast loading in a vessel in order to assess the strain rate effects is evaluated and discussed. Preliminary results indicated that the experimental and analytical methods devised were sufficiently precise, particularly in studying the effects of strain rate in thin walled vessels in the elastic field and at rupture. A considerable increase in dynamics of the elastic limit of two types of carbon and austenitic steels in static of mono- and bi-axial stress was verified. In tests on cylindrical and spherical shells, an increase of strain rate caused an equal increase in uniform strain and a decrease in the true strain. It was concluded that the behavior of a material at rupture can be explained by the strain hardening effect; and, in addition, it is noted that the manner in which the structure is deformed can be of great importance to the rupture mechanism, since this is related to the exact state of stress at the fracture point. A.C.R.

N69-29828# Tokyo Univ. (Japan).
EXPLOSION TESTS OF ARC WELDED STEEL TUBES
H. Kihara and K. Iida *In* EURATOM Shock Struct. Interactions in Reactor Vessels Oct. 1968 p 305–323 refs (See N69-29815 16-22)
Avail: CFSTI

A series of explosive tests were conducted on arc-welded tube specimens of mild steel and three kinds of high tensile steels to determine their fracture characteristics as a function of several factors. These included the assumption that the brittle fracture of a welded steel structure can occur at a temperature higher than the critical temperature under static loading, and that the fracture mode tends to be more brittle as the loading rate increases. In addition, the fracture mode also appears to be affected by material properties and welding procedures, such as manual welding, submerged arc welding, etc., as well as by treatment prior to welding. The influence of these factors and the relative performance of the different types of steels are reported. A.C.R.

N69-29852# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE IMPACT ON A THIN ELASTIC DIAPHRAGM BY A CONE
S. S. Grigoryan et al Jul. 1968 14 p ref Transl. into ENGLISH from Prikl. Mat. i Mekh. (Moscow), v. 30, no. 6, 1966 p 1035–1041
(AD-685418; FTD-HT-23-348-68) Avail: CFSTI CSCL 20/11

A complete qualitative investigation of the impact of a circular cone with a certain apex angle on an infinite elastic diaphragm of constant thickness is presented. The cone moves at a constant speed along its axis and strikes the diaphragm at a right angle. Three stages in the motion of the diaphragm material are discerned: (1) the purely radial motion of diaphragm elements in the protion of diaphragm which is not in contact with the cone; (2) radial and axial motion in the portion enveloping the cone; and (3) the motion in the portion between (1) and (2) where the diaphragm is deflected but is not yet in contact with the cone; there is a discontinuity in motion of diaphragm elements. Two time-dependent functions which describe the states of stress and strain in the diaphragm are determined for each stage, so that solutions for various impact speeds can be obtained. The effects of impact speed and of the apex angle on the deformation of the diaphragm (enveloping the cone apex) are examined at large, taking into account the angle of friction between the materials of the diaphragm and the cone. Author (TAB)

N69-29856# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

IMPACT OF A BODY ON A PLATE RESTING ON AN ELASTIC BASE

E. F. Afanasev Aug. 1968 13 p refs Transl. into ENGLISH from Uses. Simpozium po Rasprostraneniyu Uprugo-Plast. Voln v Sploshnykh Sredakh (Baku), 1966 p 149–158
(AD-684998; FTD-HT-23-445-68) Avail: CFSTI CSCL 20/11

The plane problem of collision of a finitely-wide body with a thin plate resting on the surface of an elastic medium, of the compressible-fluid type is examined. The problem reduces to the solution of an integrodifferential equation with a complex kernel and a semi-infinite interval for variable variations. The exact solution of the equation is found with the help of integral conversions and the Fock method. Simple formulas, applicable for small time intervals are found for determining the shape of the deformed plate, when the body moves with a constant velocity after the impact. A law determining the motion of the body is found when the initial velocity of the body is known. In both cases, the force acting on the body from the liquid and the plate is determined. The solution found is compared with the solution of the problem dealing with impact of a body with the surface of a compressible liquid without a cover. As a result of the comparison effects of the cover on the impact of the body with the liquid are examined. TAB

N69-29870# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

APPLICATION OF POTENTIAL THEORY METHODS TO THE STUDY OF STRESS CONCENTRATION NEAR HOLES IN SHELLS

G. M. Savin and S. P. Gavelys Dec. 1968 9 p refs Transl. into ENGLISH from Dopovidi Akak. Nauk Uk. RSR, Ser. A: Fiz.-Tech. Ta Mat. Nauki (Kiev), v. 30, no. 4, 1968 p 352–358
(AD-685015; FTD-HT-23-758-68) Avail: CFSTI CSCL 13/13

Considerable progress has been made on the problem of stress concentration near holes and indentations in plates and shells as a result of the research of Soviet and foreign investigators. Disturbances caused by individual openings, the attenuation phenomenon, disturbances on passage from the hole, and the interaction of holes among themselves were particularly studied in detail. Moreover, plates and spherical shells were quite thoroughly investigated, and somewhat less study was devoted to other aspects of shells of positive and negative curvature. An explanation of peculiarities of shells of negative gauss curvature and the establishment of dependences between the form of the average surface and the distribution of stresses at various load aspects should obviously be considered one of the problems next in turn to be considered. The essential results can be attained from the direction indicated by the setting up of general effective algorithms for the solution of a wide range of problems, which would make it possible to fully utilize the possibilities of modern computing techniques for computing a large number of variants of solutions as well as for the systemization and generalization of the information obtained. Author (TAB)

N69-29873# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

EXPERIMENTAL STUDY OF AN OSCILLATORY PROCESS IN CYLINDRICAL SHELLS EXCITED BY INSTANTANEOUS LIBERATION OF ENERGY

E. A. Limberg et al 11 Oct. 1968 16 p refs Transl. into ENGLISH from Samoletostroyeniye i Tekhn. Vozdushnogo Flota (USSR), no. 9, 1966 p 133–141
(AD-685418; FTD-HT-23-651-68) Avail: CFSTI CSCL 20/11

The present work studies the dynamic deformations of the walls of thin-walled cylindrical welded shells under a pulse of instantaneously evolved energy. The frequencies and amplitudes of the axisymmetric oscillations of the shell wall under the effect of a single pulse with instantaneous evolution of energy inside shells filled with water were measured by a synchronizing device permitting the rigid establishment in time of three moments. The method described for making sufficiently stable and precise measurements made it possible to conduct a series of experiments on the dynamic deformations of the walls of the cylindrical shells filled with liquid under an instantaneous internal load. Author (TAB)

N69-29875# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

GREAT BENDINGS OF A ROUND PLATE OF VARYING THICKNESS

A. F. Smirnov 9 Oct. 1968 17 p ref Transl. into ENGLISH from Stroit. Mekhan. (Moscow), 1966 p 277–285
(AD-685417; FTD-HT-23-650-68) Avail: CFSTI CSCL 20/11

The article deals with the bendings, moments, and forces in a round plate of varying thickness where the bendings are commensurate with the thickness of the plate but remain little in comparison. The author proceeds to derive certain nonlinear equations which can be only solved by successive approximations. These equations are so difficult that they could hardly be solved except by an electronic computer. The deformations and forces are indicated by letters and the formulas and equations by numbers. For the solution there was derived a program which enabled one to accomplish the computations, both with the taking into account and not taking into account of the nonlinearity. Author (TAB)

N69-29883 Stanford Univ., Calif.

CONTACT PROBLEMS FOR THE ELASTIC QUARTER-PLANE AND FOR THE QUARTER-SPACE

Charles Eugene Gerber (Ph.D. Thesis) 1968 100 p
Avail: Univ. Microfilms: HC $5.00/Microfilm $3.00 Order No. 68-15049

A development of the solutions is presented for the two-dimensional problem of a smooth rigid punch penetrating the boundary of an elastic quarter-plane. The case in which the extent of the contact region remains constant as the penetration increases, and the case in which the contact region increases with penetration are both treated. The contact-pressure distribution and the normal boundary displacement are derived. The method is extended to a three-dimensional problem of a smooth and rigid punch of constant width penetrating the surface of an elastic quarter-space. The variable-width punch solution requires an inverse solution search procedure. In all of the computed solutions the punch's position is referred to the corner or edge of the elastic body, and, as a limiting case, the effect of a punch in contact with the corner or the edge

is evaluated. The effect of Poisson's ratio in the three-dimensional solution is also included. The existence of a finite contact pressure at the corner or edge is associated with a coincident punch profile-slope of zero. Dissert. Abstr.

N68-29822# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CALCULATION AND EXPERIMENTAL INVESTIGATION OF PENDULAR ANTIVIBRATOR WITH FRICTION
L. I. Shtejnvolf et al. 9 Aug. 1968 19 p refs Transl. into ENGLISH from Resp. Mezhvedomstvennyy Nauchno-Tekh. Sb. Teoriya Mekh. i Meshin (Kharkov), no. 1, 1966 p 102–110
(AD-685532; FTD-MT-24-220-68) Avail: CFSTI CSCL 21/7

A method is proposed for calculating the parameters of a pendulum-type damper as applied to multiple-mass torsional systems. The computational formulas are based on theoretical research. Since this type of damper has not been used in actual systems, its operation was experimentally checked on a special laboratory setup. The results of the experimental studies are given and compared with the results of calculation by the proposed method. The following conclusions are made on the basis of experimental investigation of the operation of the pendulum-type damper. This type of damper is an effective means for reducing the amplitude of torsional resonance vibrations. The addition of a tuned damper to the experimental installation reduced the elastic moments (stresses) in the couplings by a factor of 3-5 as compared to those in the system without the damper. The proposed computational method has been checked out satisfactorily by experiment, and may be recommended for calculation in real systems. The optimum coefficient of viscous friction may be varied over a wide range, which is important from the standpoint of operation and adjustment of the pendulum-type damper. In contrast to the pendulum-type vibration mount, the maximum effect in the pendulum-type damper is reached at a certain negative frequency difference. Author (TAB)

N68-29938# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
CERTAIN PROBLEMS OF THE MECHANICS OF HIGH PARAMETERS
P. M. Ogibalov and I. A. Kiiko Nov. 1968 53 p refs Transl. into ENGLISH from the book "Ocherki po Mekhanike Vysokikh Parametrov" Moscow, Izd.-Vo Moscow Univ., 1966 p 211–249 (AD-685510; FTD-MT-24-353-68) Avail: CFSTI CSCL 20/11

The paper is a continuation (Chapter 4) of a larger work on mechanical properties of materials, especially metals. In this chapter the authors show, using concrete examples, how problems can be formulated and solved in which the influence of parameters of the process is considered. There are six sections to the chapter. These are: (1) Flow of plastic material over surfaces, (2) Flow in conditions of heat exchange, (3) Calculation of forces of inertia in processes of flow, (4) Problem of maximum shear force, (5) Problem of a thick-walled cyclinder and (6) Spheric explosion in the ground. TAB

N68-29949# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
OSCILLATION OF A LINEAR VIBRATOR AS A RANDOM PROCESS
V. I. Osorin 21 Aug. 1968 43 p refs Transl. into ENGLISH from Tr. Politekhnicheskii Inst. (Leningrad), no. 210, 1960 p 171–198
(AD-685524; FTD-MT-24-199-68) Avail: CFSTI CSCL 20/11

Statistical methods used in practical applications of the theory of oscillations of mechanical systems, necessitated by the presence of unaccountable factors (random variables), are discussed. Topics include: (1) Free oscillations of a system with one degree of freedom with random values of parameters under random initial conditions; (2) Oscillations of a vibrator under the influence of a random perturbing force, represented by canonical expansion; (3) Oscillations of a vibrator under the influence of a stationary random perturbing force; (4) Oscillations of a vibrator under the influence of a random perturbing force with assigned discrete frequency spectrum; (5) Oscillations of a vibrator under the influence of a random perturbing force of general form. TAB

N68-30020 Road Research Lab., Crowthorne (England).
A METHOD OF MEASURING THE TENSIONS IN BOLTS
D. S. Moss 1968 15 p refs
(RRL-LR-100) Copyright. Avail: Issuing Activity

High strength friction grip bolted connections depend for their strength upon friction at the interfaces or faying surfaces. These surfaces need protection from corrosion and the changes that the various coatings make to the slip factors were investigated. An essential requirement in the experimental work is an accurate measurement of the tension in each bolt of the assembled joint. A method of measuring bolt tension has been developed in which the bolt is fitted with an internal rod, which remains unstressed when the bolt is loaded by tightening the nut. As the bolt extends under load, relative movement occurs between the free end of the rod and a reference plane on the bolt head. This movement may be measured and related to bolt tension by calibrating the bolt against a suitable load cell. An accuracy of ± 2.48 kN (± 0.25 ton f) for bolt tensions of 159 to 259 kN (16 to 26 ton f) is achieved by the method described. The load-indicating bolt described is the subject of an application for a patent. Author

N68-30030# Florida State Univ., Tallahassee. Dept. of Statistics.
RANDOM WEAR MODELS IN RELIABILITY THEORY
David S. Reynolds Mar. 1969 96 p refs
(Contract Nonr-988(13))
(AD-685596; FSU-M153) Avail: CFSTI CSCL 14/4

Gaver and Antelman and Savage have proposed models for the distribution of the time to failure of a simple device exposed to a randomly varying environment. Each model represents cumulative wear as a specified function of a nonnegative stochastic process X with independent increments, and assumes the reliability of the device is conditioned upon realizations of this process. From these models are derived the corresponding unconditional joint distributions for the random failure time vector of n independent, identical devices exposed simultaneously to the same realization of the wear process. Conditions are given under which both models can give rise to identical one-dimensional failure time distributions. Joint failure time distributions are obtained in explicit form and the probabilities of ties and tie configurations are derived. Maximum likelihood estimates are obtained for certain relevant parameters for each of the models when X(t) is a process with stationary nonnegative increments. TAB

N68-30033# Purdue Univ., Lafayette, Ind.
THE SCATTERING OF ELECTROMAGNETIC WAVES BY PERFECTLY REFLECTING OBJECTS OF COMPLEX SHAPES
Final Scientific Report, 1 Feb. 1963–30 Jun. 1968
F. V. Schultz 31 Jul. 1968 91 p refs
(Contract AF 19(628)-1691)
(AD-685166; TR-EE68-39; AFCRL-68-0511) Avail: CFSTI CSCL 16/4

The objective of the contract was to carry out a theoretical investigation of the scattering of an incident plane electromagnetic wave by perfectly conducting bodies of somewhat irregular shape. The results were to be applicable in the so-called resonance region, where the major dimensions and of the order of a free-space wavelength in size. The objects which were investigated included a cone of finite height, a circular cylinder of finite length, a cube, a finned circular cylinder of infinite length, a finned sphere, and

a hemisphere. Solutions and numerical results for the radar cross section were obtained for the finite cone, the finned cylinder, and the finned sphere. The solution for the hemisphere has been obtained and numerical results are in the process of being secured. Some attention also was given to the problem of altering the scattering characteristics of reflecting objects without altering their essential configurations. Results were obtained for scattering by a long wire. Author (TAB)

N69-30040# Technical Univ. of Denmark, Lyngby. Building Materials Lab.
OECO MATERIALS ADVISORY COMMITTEE, SUBCOMMITTEE ON EDUCATION
Torben C. Hansen Dec. 1968 23 p Meeting held at Copenhagen, 8 Dec. 1968
(TR-3) Avail: CFSTI

The fundamentals of materials science, education and training of the needed scientists, and methods of introducing effective educational programs into European universities were discussed. It was concluded that this curriculum should be offered at the graduate level, due to the advanced nature of the required courses. Four arrangements were suggested for implementing such a program into a traditional European university. It was also mentioned that materials scientists are hired almost exclusively by the aerospace and electronics industries and by atomic research laboratories. The fact that traditional materials companies do not take advantage of the knowledge and skill of properly trained professionals was attributed to the information gap between university and industry which must be bridged before materials science can have any overall impact in this area. A.C.R.

N69-30103 Laboratorio de Acustic e Sonica, Sao Paulo (Brazil).
ULTRASONIC INSPECTION OF STEEL PLATE ACCORDING TO ASTM-435/67 AND VDEh-072/57 [INSPECAO ULTRA-SONICA DE CHAPA DE ACO DE CONFORMIDADE COM ASTM-435/67 E VDEH-072/57]
L. X. Nepomuceno, C. Mendonca Filho, and W. P. Monteiro [1968] 6 p In SPANISH; ENGLISH summary
(Rept-6809.334) Avail: CFSTI

A description of the equipment, accessories, and procedure, specifications and standards adopted for the ultrasonic inspection of steel plates is given. The results are presented in drawing form, indicating the defects and their position. Also included are photographs of the observed echograms. Author

N69-30112# Texas A&M Univ., College Station. Dept. of Industrial Engineering.
A BATDORF TYPE MODIFIED EQUATION FOR THE STABILITY ANALYSIS OF ANISOTROPIC CYLINDRICAL SHELLS
R. E. Martin and Dan D. Drew 21 Mar. 1969 21 p refs
(Contract N00014-68-A-0140; Proj. Themis)
(AD-684868; THEMIS-TR-10) Avail: CFSTI CSCL 20/11

The paper develops a simplified method for the stability analysis of anisotropic cylindrical shells subjected to various loading conditions. The result is a single fourth-order differential equation in the radial displacement w. The resulting equation is analogous to Batdorfs modified equation and reduces to this equation for the case of isotropic materials. Numerical results are presented for plywood cylinders and application of the development to shells of various wall constructions is discussed. Author (TAB)

N69-30189# Deutsche Forschungsanstalt fur Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Flugzeugbau.
CALCULATION OF TWO-LAYER FILAMENT-WOUND SHELLS UNDER INTERNAL PRESSURE [BERECHNUNG ZWEISCHICHTIGER, DURCH INNENDRUCK BELASTETER FASERGEWICKELTER ROTATIONSSCHALEN]
Bodo Geier Dec. 1968 79 p refs refs In GERMAN; ENGLISH summary
(DLR-FB-68-84) Avail: CFSTI

Netting analysis is used to derive the differential equations of the shapes of shells of revolution composed of two filament-wound layers. In addition formulas are given for calculating weight and volume of these shells. The equations are presented in such a way that solutions may easily be obtained using standard numerical integration procedures for systems of ordinary differential equations. In graphs and tables a number of solutions are presented for systematically varied values of the parameters governing the problem. An example is given in order to demonstrate how the tables and graphs are to be used. Author (ESRO)

N69-30198# Princeton Univ., N.J. Frick Chemical Lab.
STUDIES OF THE TOUGHNESS OF POLYCARBONATE OF BISPHENOL A IN LIGHT OF ITS SECONDARY TRANSITION
Giancarlo Locati and Arthur V. Tobolsky Feb. 1969 60 p refs
(Contract N00014-67-A-0151)
(AD-685606; TR-115) Avail: CFSTI CSCL 11/9

Results from different techniques on amorphous polybisphenol-A carbonate (mainly NMR, dielectric and mechanical) in the temperature range -150C to room temperature were reviewed. Shear creep and stress relaxation measurements were able to resolve into two components the broad relaxation process (gamma transition), the high asymmetry of which was previously apparent from the results of torsion pendulum experiments. One of the two processes is attributed to relaxation of carbonate groups; the other seems to originate from some restricted motions of the phenyl groups. An attempt to correlate the high impact strength of polybisphenol-A carbonate and the observed molecular movements was made. Author (TAB)

N69-30215# Columbia Univ., New York. Dept. of Civil Engineering and Engineering Mechanics.
A SOURCE OF DISSIPATION THAT PRODUCES AN INTERNAL FRICTION INDEPENDENT OF THE FREQUENCY
W. P. Mason Mar. 1969 29 p refs
(Contract Nonr-266(91))
(AD-684840; TR-61) Avail: CFSTI CSCL 13/2

Many measurements of the internal friction of metals and other materials such as the earths crust show that there is a component at low frequencies which produces a value independent of the frequency. It has been shown that this component is associated with dislocation motion. Using a model for which dislocation motion results from the motion of kinks, it is shown that such a loss can be associated with the energy dissipated when kinks cross Peierls barriers. At the low stresses used in internal friction measurements, it requires a thermal activation to cause motions of the kinks. The lag of the motion behind the applied stress produces a drag coefficient B proportional to the temperature. The energy dive to kink dissipation produces an internal friction to modulus change ratio, equal to the ratio of the dynamic to the static kink stress. Measurements in copper indicate that this ratio is about 0.04 in agreement with calculations. Author (TAB)

N69-30216# Southwest Research Inst., San Antonio, Tex. Dept. of Mechanical Sciences.
INVESTIGATION OF WATER IMPACT OF BLUNT RIGID BODIES-SIZE SCALE EFFECTS

C. Richard Garlach. Nov. 1968. 41 p. refs
(Contract N00014-67-C-0213)
(AD-684691; TR-2) Avail: CFSTI CSCL 13/10

The results of an experimental study of the influence of model size on the blunt body water impact problem are given. It is demonstrated that a size scale effect definitely exists; further, it is demonstrated that the model weight is another important parameter which must be considered. If the weight per unit of model area is held constant, then the peak impact pressure tends to decrease as model size increases for a given drop height (impact velocity). Comparison of the present test data with the theoretical results of Verhagen showed this theory to predict peak impact pressures which are high by a factor of about four. It is concluded that the neglect of water compressibility in the Verhagen model is, at least partly, responsible. Experiments were performed with both two- and three-dimensional air flow conditions; other than reducing the peak pressure values, restricting the air flow seems to have little or no effect on the physical picture of the blunt-body, still-water impact problem. A few tests involving impacts on a disturbed or wavy water surface showed, as was demonstrated in an earlier report, that the peak pressures are greatly reduced (in a random fashion) compared with the still water case. It is concluded that the physical process during impact on a wavy surface is different than with still water. Author (TAB)

N69-30236*# New York Univ., N.Y. Dept. of Civil Engineering.
NONLINEAR STRUCTURAL VIBRATIONS BY THE LINEAR ACCELERATION METHOD
Edward N. Wilson and Thomas P. Herrmann. Jan. 1969. 60 p. refs
(Grant NGR-33-016-067)
(NASA-CR-101676; S-69-1) Avail: CFSTI CSCL 20K

The dynamic response of nonlinear elastic structures is obtained by a step-by-step, numerical integration procedure. Two general types of systems are considered: multi-degree-of-freedom discrete systems, and continuous systems of infinite degrees of freedom. The response of a shallow arch is determined to illustrate the application of the procedure to continuous systems. Linear viscous damping is included and no restrictions are placed on the variation of the excitations in space or time. Free or undamped motion is a special case of the general formulation. The effect of any properly posed set of initial conditions can be evaluated since the numberical results represent the total response including transients. The feasibility of treating large numbers of modes or degrees of freedom is limited only by computer storage and processing time. Author

N69-30242*# Pittsburgh Univ., Pa. Space Research Coordination Center.
BOUNDS FOR THE NATURAL FREQUENCIES OF A PLATE SUBJECTED TO A THERMAL GRADIENT
G. Fauconneau and R. D. Marangoni. 7 Mar. 1969. 33 p. refs
(Grants NsG-416; NGL-39-011-002)
(NASA-CR-101682; SRCC-95) Avail: CFSTI CSCL 20K

The effect of a constant thermal gradient on the transverse vibrational frequencies of a simply supported rectangular plate is investigated. Bounds for the eigenfrequencies are obtained for various plate width-to-length ratios as functions of a parameter related to the temperature dependence of the modulus of elasticity of the material. The upper bounds are calculated by the Rayleigh–Ritz method and the lower bounds by the Bazley–Fox second projection method. In all instances, the gap between the bounds over their average is less than one half of one percent. Author

N69-30273*# General Electric Co., Cincinnati, Ohio. Missile and Space Div.
DETERMINATION OF BIAXIAL CREEP STRENGTH OF T-111 TANTALUM ALLOY. Semiannual Report, 8 Sep. 1968–8 Mar. 1969
L. H. Engel, Jr. 17 Jun. 1969. 25 p. refs
(Contract NAS3-9437)
(NASA-CR-72541; GESP-237) Avail: CFSTI CSCL 20K

Machining and ultrasonic inspection of a test capsule from the welded and reworked T-111 alloy tube has been completed. The capsule is now ready for postweld annealing. Testing of biaxial creep capsule I, fabricated from seamless T-111 alloy tubing, was initiated. As of March 8, 1969, 3635 hours of testing have been completed with the capsule at 2200°F. At that time the equivalent uniaxial creep was 0.98% in the liquid zone and 0.93% in the condensing zone. The fourth preliminary uniaxial test has been completed. The first 5000-hour uniaxial creep test was initiated at 2200°F with a stress of 8100 psi. As of March 8, 1969, 1914 hours of testing have been completed. Author

N69-30322# National Aeronautical Establishment, Ottawa (Ontario).
A HIGH PRECISION TRIANGULAR PLATE-BENDING ELEMENT
G. R. Cowper, E. Kosko, G. M. Lindberg, and M. D. Olson. Dec. 1968. 73 p. refs
(AD-685576; NAE-LR-514; NRC-10827) Avail: CFSTI CSCL 20/11

A fully conforming, displacement-type, finite element of triangular shape is developed and applied to the solution of several problems in the bending of plates. The deflection is represented by a fifth degree polynomial in the Cartesian coordinates of the mid-plane. Six deflection parameters, namely the displacement and its first and second derivatives, are specified at each vertex, yielding a total of 18 degrees of freedom for the element. Examples treated include static and dynamic analyses of a square plate with edges simply supported or clamped; statics of a triangular, simply-supported plate; and vibrations of cantilevered triangular plates. Rates of convergence of the finite element approximations are investigated both theoretically and numerically. Excellent accuracy is achieved in all cases, and the rates of error convergence agree closely with predicted asymptotic values. Author (TAB)

N69-30329# Nord Aviation, Chatillon-sous-Bagneux (France).
INFLUENCE OF STRAIN CONCENTRATIONS AND NOTCHES ON FATIGUE RESISTANCE [INFLUENCE DES CONCENTRATION DE CONTRAINTE ET DES ENTAILLES SUR LA RESISTANCE EN FATIGUE]
William Barrois. Feb. 1969. 43 p. refs. In FRENCH. Presented at INSA Study Week on Mental Fatigue, Villeurbane, France, 3–7 Feb. 1969
Avail: CFSTI

It is shown that the notch, or the stress gradient, is a factor which plays an important role in metal fatigue. The different types of rupture modes found in actual constructions are enumerated. The effects of stress concentration on polished, notched plate and cylinder test pieces were determined, after theoretically defining the factors involved. It was emphasized that the differences which exist between the design level and the actual structure scale of the metal must be kept in mind when interpreting test results of metal fatigue. Transl. by B.P.

N69-30338# Boeing Co., Seattle, Wash. Office of International Operations.
STATE-OF-THE-ART AND FUTURE AIMS OF FATIGUE STRENGTH RESEARCH
Mar. 1969 90 p Transl. into ENGLISH from the German Rept. TB-80 Presented at the 30th LBF Anniv. Colloq., 27 May 1968
(F-259; TB-80) Avail: CFSTI

Methods of serviceability testing for determining aircraft life requirements are summarized. The objective of such tests is to establish fracture strength requirements of individual components under oscillating stress over the anticipated lifetime of the aircraft and to avoid over-dimensioning of these requirements. Serviceability values must therefore be geared to tolerable stresses in the individual case to the existing stress conditions and the structural conditions of the material, the component shape, and manufacturing side effects. The counting methods and analytical techniques used to characterize load-time functions are briefly described, and a short account of future directions in strength testing is given. Detailed discussions are also included for several special topics related to fatigue strength testing, load-time analysis, material selection, and lifetime evaluation. A.C.R.

N69-30385# Laboratorium fur Betriebsfestigkeit, Darmstadt (West Germany).
THE FATIGUE STRENGTH OF WELDED JOINTS EXAMINED BY LOCAL STRAIN MEASUREMENT [DIE SCHWINGFESTIGKEIT VON SCHWEISSVERBINDUNGEN AUS DER SICHT EINER OERTLICHEN BEANSPRUCHUNGSMESSUNG]
E. Hailbach 1968 286 p refs In GERMAN; ENGLISH summary
(FB-77) Avail: CFSTI

Local strain gage measurements were performed at the point of crack initiation of fatigue-loaded welded joints in order to determine whether these local measurements are of greater accuracy than calculated estimates obtained in advance. The allowable strain amplitude in the measurements was also considered. Welded samples of two different structural steels were used for the measurements. The measuring techniques, stress distribution in the bead, and fatigue strength were evaluated. K.W.

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N69-29004 North Carolina Univ., Chapel Hill.
UNIMOLECULAR THERMAL DECOMPOSITION OF AZOMETHANE
Do-Ren Chang (Ph.D. Thesis) 1968 88 p
Avail: Univ. Microfilms: HC $4.60/Microfilm $3.00 Order No. 69-1590

The unimolecular thermal decomposition of azomethane-d using nitric oxide as an inhibitor, has been studied at three different temperatures between 256° and 297°C and at six different pressures between 1 mm and 150 mm of Hg. The rate constant has the form of an Arrhenius expression with activation energy of 51.3 kcal/mole and pre-exponential factor of $10^{18.7}$ sec^{-1} at the high pressure limit. The unimolecular behaviour of the rate inhibited rate constant is compared with the RRKM theory in its semi-classical approximation. All vibrational degrees of freedom are taken as active. The high pre-exponential factor was interpreted via three-center bond formation mechanism. The activation energy of the deuterium abstraction in this type of reaction is reported for the first time, and is about 12 kcal/mole. Dissert. Abstr.

N69-29043# Bettis Atomic Power Lab., Pittsburgh, Pa.
WIGL 3: A PROGRAM FOR THE STEADY-STATE AND TRANSIENT SOLUTION OF THE ONE-DIMENSIONAL, TWO-GROUP, SPACE-TIME DIFFUSION EQUATIONS ACCOUNTING FOR TEMPERATURE, XENON, AND CONTROL FEEDBACK
A. V. Vota, N. J. Curlee, Jr., and A. F. Henry Feb. 1969 69 p refs
(Contract AT(11-1)-GEN-14)
(WAPD-TM-788) Avail: CFSTI

A description is given of WIGL3, a program for the steady state and transient solution of the one dimensional, two group, space–time diffusion equations with zero, one, or six delayed neutron groups. The program will treat slab, cylindrical, and spherical geometries and includes non-boiling heat transfer, Xenon feedback and feedback effects due to fuel and coolant temperature are accounted for. Control rod motion and control system feedback based on total core power or outlet coolant temperature can be simulated. Transients may be excited by prescribed changes in inlet coolant temperature, coolant flow rate, or rod position. For the steady state option, criticality may be achieved by adjusting control rod position, reference coolant density, or reference fuel temperature. The governing equations and a description of the input and edit features of the program are included. Author (NSA)

N69-29098# Argonne National Lab., Ill.
COOLANT-STRUCTURE COUPLING DURING A RAPID INSERTION OF ENERGY
K. Y. Narasimhan, G. S. Rosenberg, and M. W. Wambsganss, Jr. Oct. 1968 44 p refs
(Contract W-31-109-eng-38)
(ANL-7502) Avail: CFSTI

The results of a series of preliminary studies are presented which lead to an eventual assessment of the influence of the bounding structure on the results of out-of-pile coolant-dynamics investigations. The application of the results of these investigations to an actual reactor is described. It is postulated that the bounding structure can couple with the coolant dynamics and, acting as an energy-absorbing mechanism, materially influence the characteristics and propagation of coolant transients following a disturbance. The studies demonstrate this coupling and its dependence on structural flexibility and geometry. Author (NSA)

N69-29158# Boeing Co., Seattle, Wash. Office of International Operations.
INTERACTION BETWEEN HEAT FLOWS AND MELTING ABLATION
J. Luneau Jan. 1969 30 p refs Transl. into ENGLISH from French Presented at AFITAE 5th Colloq. of Appl. Aerodynamics, Nov. 1968
(B-824) Avail: CFSTI

Aluminum spheres of 8 mm diameter are launched by means of a light gas gun into the ISL reentry simulator. The combustion

heat flow, sensitive essentially to the increase in specific air mass encountered by the model along its trajectory, rapidly exceeds the convection flow which decreases in proportion to the speed. Under these conditions, the models experience a strong melting ablation and evolve towards a very pronounced conical ogive shape. The liquid layer of melted metal causes the interactions between incident heat flow and the beginning of ablation. In particular, combustion is conditioned by the laminar or turbulent nature of this liquid film. Author

N69-29192# Boeing Co., Seattle, Wash. Office of International Operations.
AIR INTAKES FOR FLIGHT AT MACH 7
J. Leynaert Jan. 1969 19 p refs Transl. into ENGLISH from French Presented at 5th Colloq. on Appl. Aerodynamics, Nov. 1968
(E-267) Avail: CFSTI

The study of a hypersonic ramjet with fixed combustion chamber throat demonstrates that the combustion should pass progressively from the subsonic to the supersonic regime during the accelerated phase of the flight. Depending upon the Mach number that has been selected at the start of supersonic combustion, the air intake configuration and the manner of adapting it to the flight Mach number can be quite different. If for a cruising Mach of 7, combustion must start at Mach 4, the production of high mass flow at the lower velocities is facilitated by a weak internal contraction of the supersonic duct, and an air inlet may be defined which remains matched over a fairly large flight regime. If on the other hand one selects Mach 2 to start the combustion, the possibilities of matching the air intake are more restricted, and one may wind up with a configuration that is not well matched to the higher Mach numbers. Preliminary wind-tunnel tests of such a configuration are given. The final choice will also depend upon the efficiency of supersonic combustion, which is not well known, but would normally be expected to favor the first solution. Author

N69-29197*# Techtran Corp., Glen Burnie, Md.
A GENERAL METHOD FOR DETERMINING THE EFFECT OF AN EXPLOSION [UN METODO GENERALE PER LA DETERMINAZIONE DEGLI EFFETTI DI UNA ESPLOSIONE]
Michele Sirinian Washington NASA May 1969 20 p refs Transl. into ENGLISH of the publ. "Atti del Centro Ricerche Aerospeziali, no. 16, Luglio 1968" Roma, Univ. Degli Studi, July 1968 p 1–24
(Contract NASw-1695)
(NASA-TT-F-12272) Avail: CFSTI CSCL 19A

The principle of similarity yields, for each geometrical configuration, a unique law to determine a certain effect regardless of the physical characteristics of the means which fills the ambient and of the energy released by the explosive reaction. Only one geometrical configuration is analyzed: the surface burst. For this configuration the curves to determine the overpressure, the arrival time and the duration of explosive wave are given. As an example the said curves are used to calculate the effects of a given burst of energy released on the surface of three different planets. Author

N69-29208# McGill Univ., Montreal (Quebec). Hypersonic Propulsion Lab.
COMMENTS ON FORCED CONVECTIVE HEAT TRANSFER TO COOLED CYLINDERS
A. M. Ahmad *In* Md. Univ. Advan. in Hot-wire Anemometry Jul. 1968 p 65–70 (See N69-29201 16-14)
(Grant DRB-G-9550-06)
Avail: CFSTI

As related to cooled film anemometry, a forced convective heat transfer correlation for circular cylinders in cross-flow was determined for variable and variable ranges that are likely to be encountered by cooled films in flames, hypersonic wakes, rocket nozzle flows, and other high temperature environments. Flow conditions were simulated in a plasma jet; and jet conditions were maintained so that ionization was negligible, recombination was complete, and turbulent intensity was low at the points of measurement. Constant temperature, quartz coated, cooled films were used as the heat transfer surface. A.C.R.

N69-29299# Argonne National Lab., Ill. Reactor Engineering Div.
ANALYTICAL AND EXPERIMENTAL STUDIES OF DOUBLE-PIPE COUNTER FLOW LIQUID METAL HEAT EXCHANGERS
Ray Wilford Brown, Jr. (Ph.D. Thesis–Notre Dame Univ.) Aug. 1968 140 p refs
(Contract W-31-109-ENG-38)
(ANL-7479) Avail: CFSTI

The mathematical treatment is based on an exact solution of the basic energy equation. The solution presented is an extension of the classical Graetz problem to boundary conditions appropriate to heat exchangers. The analysis results in a solution for the fluid temperature profiles over the entire length of the heat exchanger, including the thermal entrance regions. The mathematical analysis was used to compute heat-exchanger efficiencies and heat transfer coefficients. The analytical results indicate that the traditional method of heat-exchanger design could lead to inaccuracies when applied to liquid metal heat exchangers. An experimental program to obtain performance curves for liquid metal heat exchangers was conducted, using a promising new technique for measuring overall heat transfer coefficients. The experimental results supported the results of the mathematical analysis, particularly for short heat exchangers, in which most of the heat transfer occurs in the thermal entrance regions. Author (NSA)

N69-29396 Polytechnic Inst. of Brooklyn, N.Y.
TEMPERATURE AND THERMAL STRESS PROBLEMS OF THIN-WALLED SPHERES AND CONES WITH AERODYNAMIC HEATING
Szu Hsiung Chu (Ph.D. Thesis) 1968 141 p
Avail: Univ. Microfilms: HC $6.80/Microfilm $3.00 Order No. 68-16237

A number of exact and approximate solutions are presented for the axisymmetrical temperature distribution and thermal stresses in thin spherical, conical and spherically-blunted shells. In the heat conduction analysis, the thermal input is assumed to be in the form of aerodynamic heating. Spherical shell and truncated cone problems with various boundary conditions are solved; also presented are solutions involving a combination of these shell elements, namely, a spherically-blunted cone. Thermal stress solutions are obtained for the foregoing problems. The governing equations assume no coupling between the thermal and elastic fields. J. W. Geckeler's assumptions are used to get the approximate solutions for hemispherical, conical, and combined shell configurations. Both simply-supported and fixed-edge boundary conditions are considered. Dissert. Abstr.

N69-29400 Northwestern Univ., Evanston, Ill.
DETERMINATION OF RADIAL TEMPERATURE PROFILES IN AN AXIALLY SYMMETRIC PROPANE-AIR DIFFUSION FLAME

Gary Dean Kuhn (Ph.D. Thesis) 1968 109 p
Avail: Univ. Microfilms: HC $5.40/Microfilm $3.00 Order No. 69-1875

Experimental techniques were investigated for determining the radial temperature distribution of an axially symmetric propane-air diffusion flame. Self-absorbed radiation from solid carbon particles in the flame as well as from the 5890Å Sodium D line was examined spectroscopically. Radial distributions of emission and absorption were computed by numerical methods from experimental data. The temperature distribution was determined by applying Kirchoff's law to the local coefficients of emission and absorption. The flame was operated at a low rate of flow and protected by screen shields. This produced an axially symmetric structure consisting of fuel at the center, surrounded by a shell of luminous carbon particles, then a shell of other reaction products, then the ambient air. Dissert. Abstr.

N69-29412# ARO, Inc., Arnold Air Force Station, Tenn.
TABLES OF EQUILIBRIUM THERMODYNAMIC PROPERTIES OF ARGON. VOLUME 1: CONSTANT TEMPERATURE Final Report, Jan. 1966–Jan. 1968
Herbert S. Brahinsky and Charles A. Neel AEDC Mar. 1969 127 p refs
(Contract F40600-69-C-0001)
(AD-684177; AEDC-TR-69-19-Vol-1) Avail: CFSTI CSCL 20/13

Equilibrium thermodynamic data are presented for argon from a temperature of 300 to 35,000K and from a log rho of -7.0 to 2.4, where rho is density in amagats. These data are tabulated at constant temperature with density incremented. The dependent parameters are Z, E/RT, H/RT, S/R, logP, and Z*. Several sources were used in assembling the data. Author (TAB)

N69-29413# ARO, Inc., Arnold Air Force Station, Tenn.
TABLES OF EQUILIBRIUM THERMODYNAMIC PROPERTIES OF ARGON. VOLUME 2: CONSTANT PRESSURE Final Report, Jan. 1966–Jan. 1968
Herbert S. Brahinsky and Charles A. Neel AEDC Mar. 1969 215 p refs
(Contract F40600-69-C-0001)
(AD-684178; AEDC-TR-69-19-Vol-2) Avail: CFSTI CSCL 20/13

Equilibrium thermodynamic data are presented for argon from a log P of -6.9 to 4.2 and from a temperature of 300 to 35,000K, where P is pressure in atmospheres. These data are tabulated at constant pressure with temperature incremented. The dependent parameters are log H/R, log rho, Z, S/R, H/RT, and Z*. Several sources were used in assembling the data. Author (TAB)

N69-29414# ARO, Inc., Arnold Air Force Station, Tenn.
TABLES OF EQUILIBRIUM THERMODYNAMIC PROPERTIES OF ARGON. VOLUME 3: CONSTANT ENTROPY Final Report, Jan. 1966–Jan. 1968
Herbert S. Brahinsky and Charles A. Neel AEDC Mar. 1969 398 p refs
(Contract F40600-69-C-0001)
(AD-684532; AEDC-TR-69-19-Vol-3) Avail: CFSTI CSCL 20/13

Equilibrium thermodynamic data are presented for argon from an S/R of 12.6 to 101.0 and from a temperature of 300 to 35,000K, where S/R is dimensionless entropy. These data are tabulated at constant entropy with temperature incremented. The dependent parameters are log rho, log P, log H/R, gamma, E, A/AA, Z, H/RT, and Z*. Several sources were used in assembling the data. Author (TAB)

N69-29415# ARO, Inc., Arnold Air Force Station, Tenn.
TABLES OF EQUILIBRIUM THERMODYNAMIC PROPERTIES OF ARGON. VOLUME 4: CONSTANT TEMPERATURE WITH SPECIFIC HEAT AND SPEED OF SOUND DATA Final Report, Jan. 1966–Jan. 1968
Herbert S. Brahinsky and Charles A. Neel AEDC Mar. 1969 126 p refs
(Contract F40600-69-C-0001)
(AD-684531; AEDC-TR-69-19-Vol-4) Avail: CFSTI CSCL 20/13

Equilibrium thermodynamic data are presented for argon from a temperature of 300 to 35,000K and from a log rho of -5.0 to 2.4, where rho is density in amagats. These data are tabulated at constant temperature with density incremented. The dependent parameters are log P, Z, Cp/R, Cv/R, gamma, gamma E, and A/AA. Several sources were used in assembling the data. Author (TAB)

N69-29426 Northwestern Univ., Evanston, Ill.
OPTIMIZATION OF THE HEATING SECTION OF A NATURAL-CIRCULATION BOILING LOOP
David Brent Bandy (Ph.D. Thesis) 1968 282 p
Avail: Univ. Microfilms: HC $12.85/Microfilm $3.65 Order No. 69-1791

A model is developed for a natural-circulation boiling loop, assuming thermal non-equilibrium between the vapor and liquid phases. The model allows the heating section to have a variable-diameter and a variable heat flux distribution. Certain constraints are imposed on the model, such as a safety margin on the local heat flux to prevent burnout. Inlet subcooling is allowed for by the thermal non-equilibrium assumption. The simpler thermal equilibrium model is also considered. The optimal design of the heating section for maximum heat rejection rate is then considered. Optimal control theory is used to formulate the problem, with the shape of the heating section and the heat flux distribution as the design variables. The first-order relaxation procedure is used to find the optimal heat flux profile, which for most cases turns out to be bang–bang, that is, on either its upper or lower constraint at all points. Dissert. Abstr.

N69-29579# Dayton Univ., Research Inst., Ohio.
A THEORETICAL MODEL FOR CALCULATING THE DEBYE TEMPERATURE OF SOLIDS Technical Report, 15 Jun.–15 Aug. 1968
Charles F. Shoemaker, John H. Meiser, and Joseph E. Davison Wright-Patterson AFB, Ohio AFML Jan. 1969 32 p refs
(Contract F33615-67-C-1187)
(AD-685188; UDRI-TR-68-42; AFML-TR-68-340) Avail: CFSTI CSCL 20/13

The temperature dependence of the Debye parameter of tungsten has been calculated with two modifications incorporated into the original Debye theory of solids. These modifications are: (1) the assumption of a common cutoff wavelength for the elastic waves, and (2) a sinusoidal dispersion relation between the wavelength and the frequency which leads to a frequency dependence of the wave velocities. This model yields results for the Debye parameter which are in accord with experimental measurements. Author (TAB)

N69-29587# Aeronautical Research Labs., Melbourne (Australia).
AN ANALOGUE SOLUTION FOR TRANSIENT TEMPERATURES IN A SKIN/SHEAR WEB STRUCTURE
M. B. Benoy and J. M. Grandage Nov. 1968 24 p refs
(ARL/SM-332) Avail: CFSTI CSCL 20/4

A direct electrical analog circuit is described for the solution of the transient temperature distributions in aircraft wing structures resulting from rapid changes in the temperature of the boundary layer. This method is compared with an approximate theoretical solution for an integral structure and is then used to evaluate the effect of introducing a riveted joint between the skin and spar web. Author

N69-29586*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

THREE-PHASE HEAT TRANSFER: TRANSIENT CONDENSING WITH FREEZING ON A NONISOTHERMAL INCLINED PLANE

William A. Olsen, Jr. and Frank B. Mollis Jun. 1969 55 p refs

(NASA-TN-D-5289) Avail: CFSTI CSCL 20M

The transient phase change process that occurs when a vapor contacts a very cold inclined plate is analyzed. The vapor condenses to form a growing liquid layer that flows down the plate. Below this two phase region there is a three phase region where the thickening condensate layer flows over a growing frozen layer. Heat and mass are transferred across moving phase boundaries. The solution involves the Karmen–Pohlhausen method which results in quasi-linear partial differential equations for the phase thicknesses that are solved by characteristic and finite difference methods. Numerous two phase special cases are also discussed. Author

N69-29589*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

EXPLORATORY STUDY OF OPEN-FACE HONEYCOMB TO REDUCE TEMPERATURE OF HYPERSONIC AIRCRAFT STRUCTURE

L. Roane Hunt and R. R. Howell Washington Jul. 1969 24 p refs

(NASA-TN-D-5278; L-6383) Avail: CFSTI CSCL 20M

An exploratory study was conducted in the Mach 7 pilot tunnel to determine the effectiveness of open-face honeycomb structure as a means of reducing the temperature of a hypersonic aircraft structure. The wind tunnel tests were conducted at a unit Reynolds number of 9×10^5 per foot (3×10^6 per meter), a Mach number of 7.0, a stagnation temperature of 3400°R (1880°K), and angles of attack from 0° to 10°. The results indicate that for zero angle of attack the steady state temperatures of the surfaces beneath open-face honeycomb structure were 0.82 to 0.88 of a smooth reference surface under the same conditions. Author

N69-29705*# General Dynamics/Convair, San Diego, Calif.

VARIABLE BOUNDARY 2 HEAT CONDUCTION PROGRAM

R. F. O'Neill, G. A. Worscheck, and J. L. Kramer 5 Sep. 1968 257 p refs Revised

(Contract NAS3-8711)

(NASA-CR-101633; GDC-BTD67-004A; GDC-BTD67-004) Avail: CFSTI CSCL 20M

The Variable Boundary 2 Program is a general purpose numerical procedure for solving problems in heat transfer. The program formulates and solves a set of linear equations, each of which represents an energy balance for an elemental volume of the conducting media. Heat conduction principles embodied in the classical diffusion equation are accommodated to the heat balance equations by means of linear difference expressions. The Variable Boundary 2 Program currently employs the so-called Crank–Nicholson forward–backward differencing scheme. This report contains a brief development of the difference expression employed in the program for representation of the applicable heat conduction principles. The pertinent steps in formulation of the energy balance, the overall computational procedure, and briefly, the program input and output features are described. Detailed mathematical and engineering descriptions of the optional program features, including the current procedures for solving the heat balance equations, and the provisions for accommodating various modes of heat transfer are given. Problem input instructions are presented in detailed, methodical, simplified sequences to facilitate rapid familiarization and convenient reference. Author

N69-29768# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

RESEARCH ON COMBUSTION IN FLOW

A. V. Talantov Aug. 1968 22 p refs Transl. into ENGLISH from Izv. Vyssh. Ucheb. Zaved., Aviats. Tekh. (Kazan), 1967 p 55–65

(AD-685422; FTD-MT-24-209-68) Avail: CFSTI CSCL 21/5

The objective of the research may be formulated thus: physicochemical studies of the combustion process in flow as applied to the working process in direct flow combustion chambers of bypass gas turbine engines, and in afterburners and combustion chambers or ramjet engines. Specifically, the following problems were tackled: (1) study of the effect of various factors (mixture composition, flow velocity and turbulence, flow pressure and temperature) and flight conditions (altitude and speed) on the principal properties of the combustion process (flame velocity, combustion time, combustion zone length, rate and degree of heat release, and stabilization limits); (2) development on a scientific basis of a computation method for ramjet combustion chambers, analysis of their operation and formulation of recommendations and initial data for their design; (3) study of ways of intensifying the combustion process in ramjet combustion chambers to enable highly efficient and reliable chambers to be designed. Author (TAB)

N69-29839*# McDonnell-Douglas Astronautics Co., Santa Monica, Calif. Western Div.

LOW-TEMPERATURE HEAT PIPE RESEARCH PROGRAM

E. C. Phillips 24 Jun. 1969 116 p refs

(Contract NAS1-8000)

(NASA-CR-66792; DAC-63366) Avail: CFSTI CSCL 20M

Basic data for use in design and analysis has lagged for heat pipes operating in the range from −100° to +200° F for thermal management of spacecraft. Of most importance are wick fluid flow and evaporator performance data. Wick permeabilities and capillary pressures were measured for wicks ranging in thickness from 0.005 to 0.100 in. and structures ranging from square mesh screen to metal foams and felts. Permeabilities were also measured as a function of the menisci radii in the liquid/vapor interface. Forced flow and gravity flow measurement techniques were used. Results are presented in graphic form as a function of flow per unit area. Permeability data were found to deviate slightly from Darcy's law. Evaporator performance was determined by measuring maximum evaporator heat fluxes for metal screen, felt, and foam wick structures with water, methanol, and butanol. Heat fluxes were measured in the vapor and at the vapor pressure of the working fluid. Maximum heat fluxes at operating temperatures of approximately 100° and 150° F in the vapor of the working fluid were found to be lower than those measured in air at atmospheric pressure. Heat pipe design procedures are outlined which make use of the wick permeability and evaporator heat flux data. Figures of merit for various potential working fluids are presented. K.W.

N69-29853# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

AN ELECTRICAL ANALOG FOR NONSTATIONARY HEAT EXCHANGE IN A DISPERSED SYSTEM

N. V. Antonishin et al 8 Oct. 1968 13 p refs Transl. into ENGLISH from Inzh.-Fiz. Zh. (Moscow), v. 12, no. 5, 1967 p 592–598
(AD-685484; FTD-HT-23-857-68) Avail: CFSTI CSCL 20/13

It is shown that the system of differential equations for unsteady heat conduction in a dispersed medium may be simulated by a simple electric network. TAB

N69-29880# Institut Franco-Allemand de Recherches, St. Louis (France).
ON THE EXISTENCE OF A LOWER BOUNDARY FOR THE IGNITION TEMPERATURE OF CELLULOSE NITRATE POWDERS [UEBER DIE EXISTENZ EINER UNTEREN GRENZE FUER DIE EXPLOSIONSWAERME VON NITROCELLULOSE-PULVERN]
H. Behrens and D. Grune 1968 14 p refs In GERMAN; French summary
(ISL-T-40/68) Avail: CFSTI

The powder $C_{28.7}H_{34.1}O_{30.9}N_{9.1}$ was produced and tested in an attempt to obtain an explosive with an extremely low ignition temperature ($Q \approx 450$ kcal/kg). But at a loading density of 0.1 g/cm^3, the experiments resulted in $Q = 636$ kcal/kg with a residue of 5.4 weight % of soot. Taking into account the resulting soot residue, the calculation $Q_{theor} = 627$ kcal/kg at an ignition temperature $T_{ex} = 2280°K$. Thermodynamically, there should be no soot residue with experimental conditions at 1000 atm. Quantitatively, however, the residue can be explained when considering that a temperature gradient exists during the combustion of the powder in a closed bomb. The real reaction temperature is calculated from T_{ex} as being approximately 1700°K. at this temperature, the amount of soot and Q agree with the calculations. This indicates that no soot is reduced in a secondary reaction. The soot residue sets a lower boundary for Q.
Transl. by K.W.

N69-29923# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
EXPERIMENTAL INVESTIGATION OF ELECTRICAL CONDUCTIVITY OF PRODUCTS OF COMBUSTION, STIMULATED BY SOLID PARTICLES
E. P. Zimin et al 23 Aug. 1968 23 p refs Transl. into ENGLISH from Eksperim. issled. Elektroprovodnosti Produktov Sgoraniya, Stimulirovannoy Tavedymi Chastitsami (USSR)
(AD-685511; FTD-MT-24-183-68) Avail: CFSTI CSCL 10/2

An experimental study was carried out on the electrical conducitivity of the products of combustion of methane with oxygen-enriched air in the presence of solid particles of various substances. This question merits attention in connection with the use of MHD electric power generators. By artificially introducing solid particles it was found possible to improve the electrophysical properties of the working gas. Solid particles transported from the combustion chamber may be present in the duct of an open-cycle MHD generator working with the products of coal combustion. In addition, when there are sufficiently large temperature reductions in the rear part of the duct, particles may form through the condensation of combustion product volatiles directly into the solid phase. The experiments showed that the introduction of particles stimulates the electrical conductivity of the products of methane combustion which, without particles, are non-conducting. The dependence of electrical conductivity on gas temperature and on particle size and the relative mass flow rate of the particles was studied. Author (TAB)

N69-29925# Air Force Systems Command, Wright-Patterson AFB, Ohio.
COMPUTATION OF A DIFFUSION FLAME IN A TRANSITIONAL FLOW RANGE
Sh. A. Ershin et al Sep. 1968 9 p refs Transl. into ENGLISH from Vestn. Akad. Nauk Kaz. SSR (Alma-Ata), v. 22, no. 9, 1966 p 48–50
(AD-685512; FTD-HT-23-309-68) Avail: CFSTI CSCL 21/2

The length of diffusion flames in laminar flow regimes is directly proportional to the gas flow velocity. With increasing flow velocity, the flame becomes turbulent and the regime is transient. At high flow velocities, the flame is fully turbulent, and the length does not depend on the flow velocity. The turbulent and laminar regimes have been previously studied, but the transient regime, which involves both molecular and turbulent transfer, has not yet been thoroughly studied. In the present study, experiments in the transient regime were made with carbon monoxide and hydrogen combustion. Author (TAB)

N69-29935# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ALTERNATION OF FLOW AND HEAT EXCHANGE UNDER THE CONDITIONS OF ARTIFICIAL TURBULIZATION OF FLOW IN TUBES
E. K. Kalinin and S. A. Yarkho Jul. 1968 8 p refs Transl. into ENGLISH from Vestsi Akad. Navuk Belarusk. SSR, Ser. Fiz.-Tekh. Navuk (Minsk), no. 2, 1966 p 62–64
(AD-684994; FTD-HT-23-360-68) Avail: CFSTI CSCL 20/4

Since the results of an earlier investigation have shown that most efficient heat transfer is obtained under slight turbulization conditions, a study was made of the stability of local heat transfer in the near-critical region in tubes with turbulizers. The artificial turbulizers used were annular diaphragms of small height on the internal wall of the tube, produced by externally indenting the tube with a roller. The degree of reduction of the inside diameter of the tube diaphragms was 98.3 - 87.5%. The tube was heated with ac. The tests are briefly described. Comparison of the results with the data obtained for a smooth tube indicates that in the tube with turbulizer the temperature pulsations are produced at lower Reynolds numbers than in a smooth tube. The amplitudes of the oscillations of the wall temperature in such tubes is larger than in smooth tubes. The range of Reynolds numbers in which pulsation takes place is much smaller than in a smooth tube. The shift and decrease of the maxima of the pulsations of the characteristics on approaching the inlet to the tube is due to the character of the variation of the alternation coefficient. Author (TAB)

N69-29983# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE LENGTH OF A SUPERSONIC EJECTOR MIXING CHAMBER WITH A ZERO EJECTION COEFFICIENT
V. A. Balanin 7 Oct. 1968 13 p refs Transl. into ENGLISH Inzh-Fiz. Zh. (Moscow), v. 13, no. 4, 1967 p 564–567
(AD-685496; FTD-MT-24-346-68) Avail: CFSTI CSCL 21/2

An experimental study was made to determine the effect of the mixing chamber length on the efficiency of the ejection process at a zero ejection coefficient. The experimental data and a diagram of the mixing chamber are shown. Author (TAB)

N69-30084*# National Aeronautics and Space Administration, Lewis Research Center, Cleveland, Ohio.
TEST OF SODIUM BOILING IN A SINGLE TUBE-IN-SHELL HEAT EXCHANGER OVER THE RANGE 1720° TO 1850° F (1211 to 1366 K)
James P. Lewis, Donald E. Grassbeck, and Harold H. Christenson Washington Jul. 1968 129 p refs
(NASA-TN-D-5323) Avail: CFSTI CSCL 20M

Sodium was boiled in a vertical 1/2-inch inside diameter by 4-foot long tube. The columbium alloy boiler operated at flow rates of 75 to 380 lbm/hr and up to 0.93 quality. Boiling performance depended on whether the inlet flow was two-phase or liquid. Two phase momentum pressure drops were 1-1/2 times frictional drops. Qualities over 0.9 were obtained at some critical (burnout) boiling conditions. Liquid superheats up to 250°F existed before initiation of boiling. Author

N69-30131# Deutsche Forschungsanstalt fur Luft- und Raumfahrt, Brunswick (West Germany). Inst. fuer Strahlantriebe.
HEAT TRANSFER AT REDUCED GRAVITY [WAERMEUEBERGANG BEI VERMINDERTER SCHWERKKAFT]
Fritz Eisfeld, Lutz Reichli, Klaus-Juergen Schultz, and Wolf Spilttstoesser Dec. 1968 57 p refs In GERMAN; ENGLISH summary
(DLR-FB-68-88) Avail: CFSTI

The published literature relating to heat transfer under reduced-gravity conditions is surveyed and future research problems are indicated. Proceeding from boundary layer analysis, heat transfer by free and forced convection and the influence of reduced gravity on condensation and boiling are discussed. Experimental techniques for the production of reduced gravity conditions and some practical examples of gravity influence on heat transfer in rocket and space applications are presented. Author (ESRO)

N69-30141# European Atomic Energy Community, Ispra (Italy). Joint Nuclear Research Center.
HDP-2: A DIGITAL PROGRAM CALCULATING THE SURFACES AND THE EFFICIENCIES OF A HEAT EXCHANGER COUPLED WITH A TURBINE AT NOMINAL POWER AND AT PART LOAD. PART 1: DESCRIPTION OF THE CODE VERSION HD 2 CALCULATING THE NOMINAL POWER CHARACTERISTICS
W. Belz, C. Bona, and S. Gecchelin Brussels Apr. 1969 58 p
(EUR-4252.e-Pt-1) Avail: CFSTI

The code HDP 2 is a digital program calculating the surfaces and the efficiencies of a heat exchanger coupled with a turbine at nominal power and at part load. Steam cycles with or without reheating by the primary coolant may be treated. Different arrangements of the reheater section of the heat exchanger are possible in series with the superheater, in parallel with the superheater, and in parallel with the superheater, boiler and economizer. The heat exchanger may be of the drum boiler or Benson boiler type. The primary coolant which in the actual code version may be OM 2 or HB 40 is assumed to flow on the shell side in counterflow to the steam or water. This report describes the code version HD 2 which treats the design calculations. Author

N69-30244*# Virginia Polytechnic Inst., Blacksburg.
A METHOD FOR CALCULATING LAMINAR AND TURBULENT CONVECTIVE HEAT TRANSFER OVER BODIES AT AN ANGLE OF ATTACK Final Report
Fred R. DeJarnette and Taze C. Tai Mar. 1969 138 p refs
(Grant NGR-47-004-006; VPI Proj. 313099)
(NASA-CR-101678; SAPR-8) Avail: CFSTI CSCL 20M

The axisymmetric analogue (small cross flow approximation) is employed to develop methods for calculating laminar and turbulent heat-transfer over bodies of revolution at angles of attack. These methods are restricted to hypersonic flows over bodies with highly cooled walls. A method is presented for determining the surface inviscid streamline geometry and coordinate scale factors, which are required in the axisymmetric analogue. This method requires the surface pressure distribution to be known, whether theoretical or experimental. Results are presented for spheres, paraboloids, and spherically blunted cones at angles of attack. Surface pressures and streamline geometries were found to compare favorably with experimental data and the three-dimensional method of characteristics. Laminar heat-transfer results were also found to compare favorably with experimental data. It was found that the surface pressure distribution affected laminar heating rates more than the inviscid streamline geometry. Author

N69-30245*# Scripta Technica, Inc., Washington, D.C.
TRANSIENT TEMPERATURE FIELDS IN SHELLS
M. D. Mikhaylov NASA Jun. 1969 98 p refs Transl. into ENGLISH of the book "Nestatsionarnyye Temperaturnyye Polya V Obolochkakh" Moscow, Energiya Press, 1967
(Contract NASw-1694)
(NASA-TT-F-552) Avail: CFSTI CSCL 20M

The monograph discusses the theory of transient one-dimensional heat conduction processes occurring in plane one- and two-layer plates at various boundary conditions on the skin and the heat-resistant coating. Solutions are given for transient temperature fields in porous walls cooled by a forced flow of a cooling medium. Formulas for determining thermal stresses are also given. Detailed tables of the roots of characteristic equations and initial temperature amplitudes facilitate the use of these equations in practical computation. The solutions may be applied to designing heat shields in aircraft and rockets, or to other branches of engineering. Author

N69-30260# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
AN APPARATUS WITH A CYLINDRICAL SYMMETRY FOR MEASURING THE THERMAL CONDUCTIVITY OF HIGH POLYMERS
Hirotaro Kambe, Osamu Yamamoto, and Shoichi Igarashi Mar. 1969 9 p refs
(ISAS-438-Vol-34-NO-5) Avail: CFSTI

For the determination of the thermal conductivity of high polymers, an apparatus with a cylindrical symmetry was designed and constructed. The temperature dependence of the thermal conductivity of commercial samples of polymethyl methacrylate and polyethylene were measured with this apparatus. The thermal conductivity vs. temperature curve for the amorphous polymethyl methacrylate shows a gradual increase in the thermal conductivity with the increase in the temperature, but the curve has a sharp bend near the glass transition temperature of the polymer. On the contrary, the thermal conductivity of the semi-crystalline polyethylene decreases monotonously with the temperature, following the reciprocal temperature relationship valid for the crystalline solids of the low molecular weight. Author

N69-30317*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
THERMAL RADIATION HEAT TRANSFER. VOLUME 2: RADIATION EXCHANGE BETWEEN SURFACES AND IN EXCLOSURES
John R. Howell and Robert Siegel Washington 280 p refs
(NASA-SP-164-Vol-2) Avail: SOD $1.50; CFSTI CSCL 20M

A theory was developed for computing thermal radiation within enclosures. An enclosure is defined as an envelope of solid surfaces or open areas which completely surround a surface. By considering the radiation going from the surface to all parts of the enclosure, and the radiation arriving at the surface from all parts of the enclosure, it is assured that all the radiative contributions are accounted for. It is assumed that the medium in the space between the surfaces is perfectly transparent and does not participate in the radiative interchange. The main topics of discussion are: (1)

exchange of radiant energy between black isothermal surfaces, (2) radiation exchange in an enclosure composed of diffuse-gray surfaces, (3) radiation in enclosures having some specularly reflecting surfaces, (4) the exchange of thermal radiation between nondiffuse nongray surfaces, (5) the Monte Carlo approach to radiant interchange problems, and (6) radiation in the presence of other modes of energy transfer. For Volume 1, see N68-28530. E.C.

N69-30320# National Bureau of Standards, Boulder, Colo. Cryogenics Div.
REFRIGERATION AT 4°K
T. R. Strobridge [1968] 13 p refs Repr. from Proc. of the 1968 Summer Study on Superconducting Devices and Accelerators, Pt. 1, Apr. 1969 193–204
(R-511; BNL-50155; C-55) Avail: CFSTI

A review of the technology of liquid helium is presented. The application of the laws of thermodynamics is demonstrated by: (1) the equation for the first law of thermodynamics which shows that modern nomenclature has clarified the concept of a control volume and a thermodynamic system; and (2) the second law which is used for rating the performance of processes and cycles. The study is devoted to refrigeration methods in use today: evaporating liquid helium baths; the Simon process; and the Joule–Thompson, Brayton, Claude, Stirling, and Gifford–McMahon cycles. F.O.S.

34 GENERAL

Includes reports of a broad nature related to industrial applications and technology, and to basic research; defense aspects; law and related legal matters; and legislative hearings and documents.

N69-29123# Arizona Univ., Tucson. Weather Modification Law.
THE LEGAL IMPLICATIONS OF ATMOSPHERIC WATER RESOURCES DEVELOPMENT AND MANAGEMENT Final Report
Ray Jay Davis Oct. 1968 254 p refs
(Contract DI-14-06-D-6224)
(PB-182754) Avail: CFSTI CSCL 05D

The arguments of landowners and of weather modifiers and their clients for private rights in water resources of the atmosphere are set forth. There is an examination of the legal theories and factual situations upon which legal liability might be based for precipitation management activities and their consequences. Defenses to such liabilities and employment of insurance and indemnification agreements to obtain relief from financial losses are explored. The legal problems in local development of additional yield from atmospheric sources are set forth, and state licensing, reporting, and other regulatory activities are analyzed. Different methods of interstate allocation of water are measured against the need to allocate among the states. There is a study of federal management and development of atmospheric water resources. International implications of weather modification are also treated. The report concludes with recommendations for further acquisition of factual information about weather modification, adjustments in state laws, and enactment of federal legislation to ensure sound development. Author (USGRDR)

N69-29389*# National Aeronautics and Space Administration, Washington, D.C.
THIS IS NASA
GPO Dec. 1968 23 p
(NASA-EP-22) Avail: SOD $0.45; CFSTI CSCL 22D

A review of the first decade and growth of NASA is presented. Included topics are: exploring space, manned flight, to the moon and back, sun, planets and stars, weather eye in space, and NASA facilities. F.O.S.

N69-29492*# National Aeronautics and Space Administration, Washington, D.C.
NASA SCIENTIFIC AND TECHNICAL REPORTS FOR 1968, A SELECTED LISTING
May 1969 453 p refs
(NASA-SP-7033) Avail: CFSTI CSCL 05B

This publication contains a combined selective listing of NASA reports that were announced during 1968 in *Scientific and Technical Aerospace Reports (STAR)*, NASA's semimonthly announcement journal for the aerospace sciences. The documents listed were issued as part of the following NASA report series: *Special Publications* (NASA SP), *Technical Reports* (NASA TR-), *Technical Notes* (NASA TN D-), *Technical Memorandums* (NASA TM X-), *Technical Translations* (NASA TT F-), and *Contractor Reports* (NASA CR-). The listing does not include references to journal articles that were published as a result of NASA-sponsored activities. The volume has been limited to reports which were printed and widely distributed. Access to material thus omitted from this listing continues to be available through STAR and its indexes. The arrangement of this publication is the same as that of STAR. The first section contains the bibliographic citations and abstracts arranged by STAR subject categories. The second section contains five indexes (subject, personal author, corporate source, report/accession number, and accession/report number.) Author

N69-29620*# National Aeronautics and Space Administration, Washington, D.C.
IN THIS DECADE: MISSION TO THE MOON
1969 52 p
(NASA-EP-71) Avail: SOD $1.25 CSCL 22A

The NASA effort beginning with the thrust towards space flight and exploration in 1961 is described in an essay ending in the anticipation of the first lunar landing. Photographs of satellite technology and manned space flight hardware, the crews of Project Mercury and Apollo, communications and research facilities, test stands, assembly buildings and launch sites accompany the descriptive account which ends in a brief resume of the Apollo Applications Program. M.H.E.

N69-29668 Library of Congress, Washington, D.C. Special Bibliographies Section
AIR FORCE SCIENTIFIC RESEARCH BIBLIOGRAPHY, 1962 VOLUME 6
Thomas C. Goodwin, Vernon G. Hooker, Doris C. Yates, Parthemia A. Patrick, and Alexia H. Hatch 1968 954 p refs
(AD-681581; AFOSR-700-8) Avail: SOD $8.75; CFSTI CSCL 5/2

The document contains abstracts and bibliographic data of reports issued or published during 1962 as a result of AFOSR sponsored research. The disciplines covered include physics, chemistry, engineering sciences (subsuming mechanics and propulsion), life sciences (both biological and behavioral, but exclusive of medical), mathematics, and information sciences. Contract, OSR control number, author and subject indexes are included. The entries are arranged by corporate author. TAB

N69-29729# Bendix Corp., Ann Arbor, Mich. Aerospace Systems Div.
THE APPLICATION OF MICROTECHNOLOGY IN RESEARCH LIBRARIES
Don Dorrance Jun. 1969 22 p Presented at the Conf. on the Role of Micrographics in Modern Inform. Systems, College Station, Tex., 5-6 Jun. 1969
(Rept-6822) Avail: Issuing Activity

The total implications of microtechnology systems in research libraries are discussed. The five major advantages in a comprehensive microtechnical system (microfiche, readers, and reproduction units) were described as substantial cost savings, broad and rapid distribution of information, maintenance of file integrity, elimination of clerical (circulation control) time, and records (storage) management. The disadvantages were unpopularity with the users, the need for special equipment, and the lack of standardization in micrographics, requiring as many as five species of readers. The author's requirements, strategy, and the services provided through the use of microtechnology were outlined with credits to NASA and DDC registers for the implementation of a broad research base. M.H.E.

N69-29811# George Washington Univ., Washington, D.C. National Law Center.
THE ADVERSARY PROCESS IN TECHNOLOGY ASSESSMENT
Harold P. Green 19 Mar. 1969 21 p refs Presented at the Technol. Assessment Seminar Ser. Program of Policy Studies in Sci. and Technol., Washington, D.C., 19 Mar. 1969
Avail: Issuing Activity

The national need for an adjunctive Congressional group was discussed which would assess the benefits, risks, and costs to the public of ongoing and future scientific programs and technological breakthroughs. Technologies such as detergents, pesticides, and the supersonic transport plane were cited because a balanced view of the benefits to the American public was not available prior to Congressional legislative support of programs. The proposed agency would act as a responsible devil's advocate in both Congressional and public forums seeking out negative factors, articulating these in adversary proceedings, and formulating social control when prohibitive cost, risk, or hazard had been established. M.H.E.

N69-29867# Lincoln Lab., Mass. Inst. of Tech., Lexington.
GENERAL RESEARCH Quarterly Technical Summary Report, 1 Nov. 1968–31 Jan. 1969
Frederick C. Frick, V. Alexander Nedzel, Stephen H. Dodd, Melvin A. Herlin, Herbert G. Weiss et al 17 Mar. 1969 50 p refs
(Contract AF 19(628)-5167)
(AD-685213; ESD-TR-69-4) Avail: CFSTI CSCL 5/2

The publication covers the period from 1 November 1968 through 31 January 1969. It consolidates the reports of the following Divisions: data systems, radio physics, radar, engineering, and solid state physics, on the general research program at Lincoln Laboratory. Author (TAB)

N69-30019# Boelkow G.m.b.H., Ottobrunn bei Muenchen (West Germany).
METHODS OF OPERATION RESEARCH [VERFAHREN DES OPERATION RESEARCH]
E. Geisler 1 Jan. 1969 40 p refs In GERMAN; ENGLISH summary
(OP-138-0) Avail: CFSTI

A brief account is presented of the development of operations research as a decision making tool in modern management. The methods and formalisms of analytic and simulation models are discussed and illustrated with examples. The block diagram of a model for the simulation of a weapon system is discussed as an example of application of operations research methods to the solution of defense problems. Author

N69-30036# Joint Publications Research Service, Washington, D.C.
EVALUATING THE SCIENTIST'S WORK
Z. M. Mulchenko 4 Jun. 1969 9 p refs Transl. into ENGLISH from Priroda (Moscow), no. 3, Mar. 1969 p 73–77
(JPRS-48161) Avail: CFSTI

A cybernetic approach to the study of science is taken, and an information model of the development of science is examined. Based on the concept that science is a process of obtaining new information, an extensive discussion is presented on the important role that references play in the dissemination of scientific information. Also discussed in connection with the cybernetic approach is a new field of research, scientometry, that makes extensive use of numerical methods. Scientometry investigates the growth of information carriers and studies the language of scientific references. Further examination is made of a bibliographical reference system, called Science Citation Index, which was designed as a tool for studying the mutual interpenetration of sciences and erasure of the boundaries between them. It is concluded that the language of scientific citations may be used to trace the origin, growth, and decay of individual scientific trends; to establish feedback between the author and creatively active readers; to appraise the contribution made by individual scientific collectives and even countries to world information streams; and to analyze the arrangement of the network of scientific centers. D.L.G.

N69-30115# Advisory Group for Aerospace Research and Development, Paris (France).
AGARD BULLETIN: TECHNICAL PROGRAMME 1970
May 1969 77 p In ENGLISH and FRENCH
(AGARD-BULL-69-2) Avail: CFSTI

The content and scope of the AGARD Technical Program are presented. The technical objectives, meetings, publications, and budgets for each panel activity are outlined. A calendar of meetings for 1970 includes the location and subject topic. The publications planned for distribution are listed. Detailed task descriptions for each panel are summarized. B.P.

N69-30349# Middle East Technical Univ., Ankara (Turkey). Faculty of Arts and Sciences.
THE PATTERN OF REASONING IN SCIENTIFIC DISCOVERY
Cemal Yildirim 1968 78 p refs /ts Publ. no. 14
Avail: CFSTI

The question of whether there is a logic of discovery as distinct from the logic of verification is an old one, but it has only recently become the center of methodological interest. Recent work makes it amply clear that the question cannot be answered on purely substantive grounds. It is at least partly verbal, and whatever the particular answer may be, it is bound to depend on the concept of logic itself. An attempt is made to restate the problem in a somewhat modified form. It seeks to delineate the pattern of inference, if any, underlying the act of scientific discovery. Author

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